THE CANDIDATE
RUMSEY ECOLOGICAL RESERVE:
A BIOPHYSICAL INVENTORY

For the Natural Areas Program
Alberta Energy and Natural Resources

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Alberta

SUMMARY

This report was prepared to document field studies as consistent with Natural Areas Program policy.

The candidate Rumsey Ecological Reserve was chosen for field investigation because it is one of the 13 areas that have been initially nominated for ecological reserve status. In anticipation of future management plans for the site, additional biophysical information was required.

Field-work and literature surveys were conducted during the spring and summer of 1982 to identify and describe plant community types, compile flora and fauna species lists, assess disturbances and describe the physical environment.

The area consists of 3445 ha (13.25 mi.^{2}) and has been nominated as an ecological reserve to represent part of the aspen parkland in Alberta. It is provincial crown land administered by the Public Lands Division of the Department of Energy and Natural Resources. Most of the area is under grazing lease to Usher Ranching Ltd.

The literature was reviewed and no fieldwork conducted for bedrock and surficial geology, topography, drainage, soils, climate, history and land use.

Fieldwork and literature reviews resulted in a present vascular flora species list of 297 species distributed among 49 Families and 158 Genera. One species, an onion, is considered rare in Alberta.

Twelve plant community types were recognized in this study. Sloughs were commonly ringed with sedge, slough grass, spike rush and cattail. Along the margins of saline sloughs are salt tolerant species such as bulrush, salt grass, albalai grass, sea blite and sea milkwort. Willow community types occupy the banks of sloughs. Groves of aspen generally occur around willow areas and on mesic north-facing slopes. Snowberry communities are commonly found throughout the grasslands in mesic locations. About three-quarters of the candidate reserve is grassland dominated by rough fescue. Drier grassland areas are dominated by porcupine grass, grama grass and pasture sagewort.

Based on earlier studies and aerial photography interpretation, there has been a 15% decrease in area covered by grassland and a concurrent increase in area covered by aspen stands between 1907 and 1979.

Due to the extensive habitat loss in the parkland area in Alberta due mostly to cultivation, the candidate reserve is an important refuguim for wildlife. Eighty-one bird, 22 mammal and 6 reptiles and amphibians have been reported on site.

Most disturbances on the area are associated with the ranching operations and the oil and gas industry. The Usher Grazing Lease has had a history of good management and the range is in good to excellent condition overall.

Eight special features were identified and include the moraine plateau, the glacial spillway and esker complex, white-tailed jackrabbit, beaver, richardson's ground squirrel, red-tailed hawk nest, rare onion plant species and the ungrazed quarter section.

ACKNOWLEDGMENTS

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INTRODUCTION

The aspen parkland is a major vegetation zone unique to Canada except for small tongues extending into the states of Montana, Minnesota and North Dakota. It is an ecotone or transition zone between the prairie grasslands and the boreal forest to the north, the Cordilleran forest to the west and the deciduous forest to the east. The interaction of boreal and prairie climates creates a mosaic of *Populus tremuloides* groves interspersed with prairie grasslands.

From the Manitoba-Minnesota border the aspen parkland zones extends northwest in a band 80 - 240 km wide to the Edmonton area where it turns south and continues down into Montana as a 40 km wide zone along the foothills. Most of the major cities of the Prairies are located within or close to the aspen parkland (i.e. Winnipeg, Saskatoon, and Edmonton).

In Alberta, aspen parkland accounts for 11.1% of the area or 73 500 km^2 making it the province's second largest ecoregion (Strong and Leggat 1981).

The region is extensively cleared and cultivated. Since settlement 90 to 95 % of Canada's parkland has been altered or destroyed (North 1976).

In an effort to preserve part of the aspen parkland in its natural state 3445 ha (13 1/4 $mi.^2$) of Crown land near Rumsey, Alberta have been proposed as an ecological reserve by the Alberta Government's Natural Areas Program.

A study of the candidate Rumsey Ecological Reserve was undertaken in the summer of 1982 to gather information about the biological and physical resources within the site. The objectives of the study were to:

1) Identify and describe the plant community types
2) Compile a floral species list
3) Compile species lists of the fauna
4) Identify and describe manmade disturbances within the area
5) Describe the physical environment
6) Conduct a literature search for studies conducted in the area and incorporate into a report.

Present Administrative Status and Dispositions

The proposed Rumsey Ecological Reserve is a representative of the Central Aspen Parkland Section of the Aspen Parkland Region of Alberta (Achuff and Wallis 1977). The area is provincial Crown land administered by the Public Lands Division of Energy and Natural Resources. All but one quarter is reserved for conservation with no dispositions leading to title or inconsistent with the conservation policy (RLC4). The northwest quarter of 14-34-[illegible] is reserved for conservation with no permitted disposition (RLC7). The area under the RLC4 is part of grazing lease 33419 (Usher Ranching Ltd.).

Petroleum and natural gas leases are held on Sections 16, E 21, 22, 23, 28, 29 and 31-34-19-W4. Appendix 3 gives the location of each lease, the lessee and the expiry date of each lease. Coal rights are reserved by the Crown.

Ducks Unlimited Canada has easements (EZ 1481 and EZ 1855) on NW 16, SE and NW 20, NW and S 28, N 30, S 31 and W 32-34-19-W4. Mohawk Oil Ltd. has route access rights to their gas wells on N 22, NW 23 and NW 31-34-19-W4. Alberta Government Telephones has a buried cable on N 31, N 32, and NW 33 and a transmission line easement on N 33-34-19-W4. Alberta Power has an easement on NE 33-34-19-W4.

Presently, the candidate Rumsey Ecological Reserve is one of 13 priority sites in Alberta that are awaiting legislative approval under Bill55, The Wilderness Areas, Ecological Reserves and Natural Areas Act.

DESCRIPTION OF THE AREA

Location

The proposed ecological reserve is located 16 km northeast of Rumsey, Alberta (Figure 1). Highway 589 forms the northern border of the reserve and Highway 56 is 1.6 to 3.2 km west of the reserve's west border.

Its legal land description is:

34-19-W4:	NW 14
34-19-W4:	15, 16, 17
34-19-W4:	20, 21, 22, 23
34-19-W4:	31, 32, 33

Bedrock and Surficial Geology

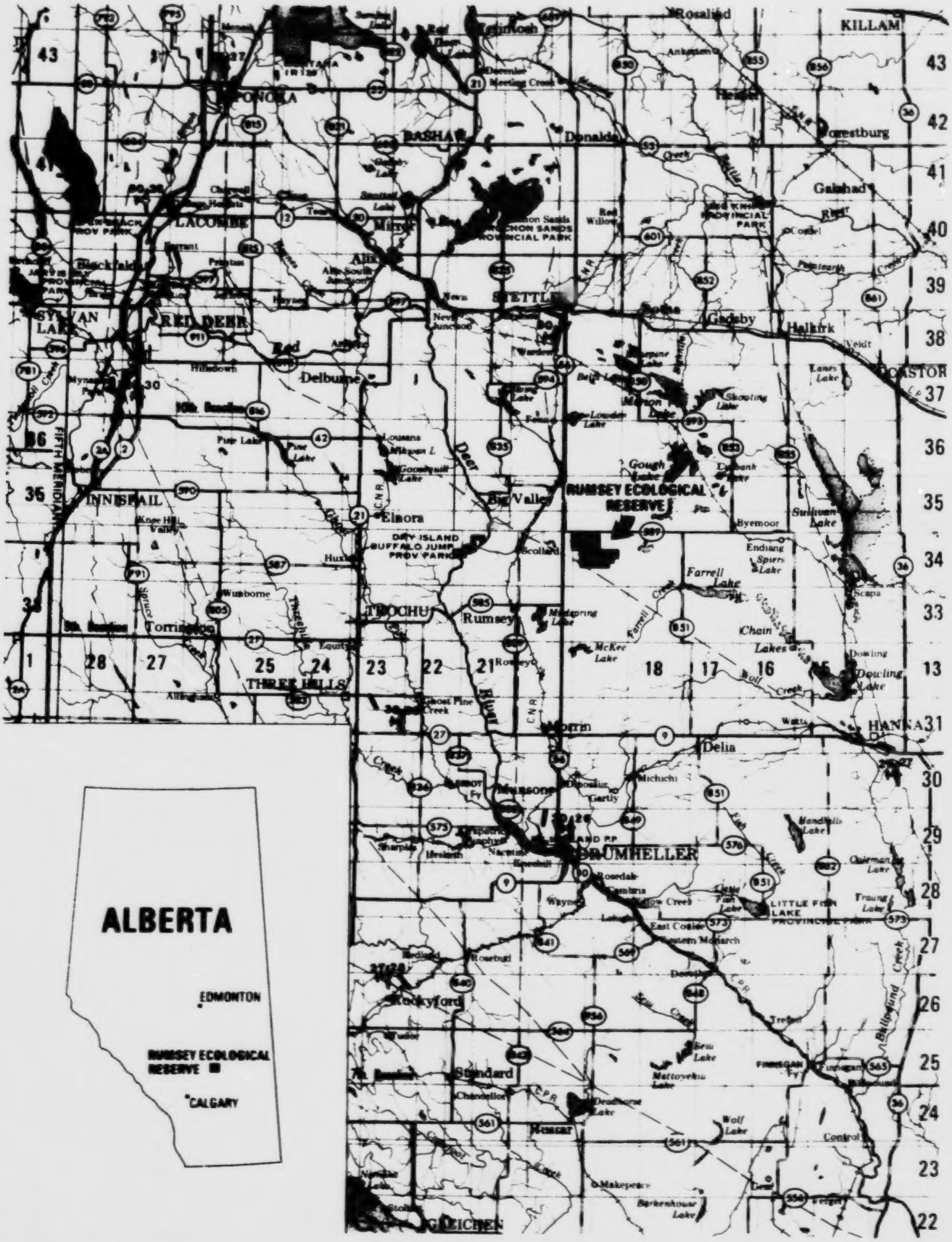
Most of the information on geology was taken from Stalker (1972).

The bedrock formations were laid in the Alberta geosyncline. The formations were result of debris outpouring from the mountain to the west during the final phase of the Cretaceous and Tertiary Seas. The deposits consist of shale, siltstone, sandstone and minor coal seams that were laid down in marine, brackish-water, freshwater and subaerial layers due to the fluctuation of the sea. The bedrock falls gradually to the west and southwest.

The candidate ecological reserve is underlain by the Paskapoo and Edmonton bedrock formations. The Paskapoo formation underlays the majority of the reserve. Figure 2 shows the distribution of the two formations within the reserve (Bowser et al. 1951). The Paskapoo formation dates from the Tertiary period. It is non-marine in origin and is characterized by grey, green and brown clay shale, grey and green siltstone, buff and brown weathering, grey sandstone and pebble conglomerate. The roughest topograghy is located on this formation because it resists erosion. The lower Edmonton formation is the uppermost bedrock horizon in the east part of the reserve. It too has non-marine origins but it was formed during the Upper Cretaceous. Characteristically, the major constituents are light-grey weathered, grey argillaceous sandstone, grey sandy and silty shale, carbonaceous shale and bentonite; however, coal seams and ironstone bands are also found throughout (Irish 1967).

The reserve and surrounding area was covered by the Keewatin Glaciation which moved southwest from the Hudson's Bay region during the late Pleistocene. Material from areas passed over by the glacier were carried and mixed with local underlying bedrock. Except for the larger Precambrian erratics, most of the original sedimentary drift material eroded away leaving the local or original bedrock.

When the glacier receeded large ice sheets stagnated and disintegrated, depositing the glacial debris, a terminal moraine, over a region from Trochu to Buffalo Lake. The hummocky disintegration moraine is known as the Beaverhills Moraine. The overburden in the candidate ecological reserve is 14 to 30 metres thick, although in places in the SW and NE corners, it is 0 - 8 metres thick.



ALBERTA
EDMONTON
RUMSEY ECOLOGICAL RESERVE
CALGARY
RUMSEY ECOLOGICAL RESERVE
Rumsey
KILLAM
Rosalind
Forestburg
Galahad
PONOKA
BASHAW
Donalda
LACOMBE
Mirror
Alix
STETTLER
Gadsby
Halkirk
RED DEER
Delburne
CORONATION
INNISFAIL
Elnora
Big Valley
Byemoor
Endiang
Sullivan Lake
DRY ISLAND BUFFALO JUMP PROV PARK
Scollard
Huxley
TROCHU
Farrell Lake
Chain Lakes
Torrington
THREE HILLS
McKee Lake
Dowling Lake
Morrin
Delia
HANNA
Munson
DRUMHELLER
Rosedale
Wayne
LITTLE FISH LAKE PROVINCIAL PARK
Rosebud
Rockyford
Standard
Finnegan
Hussar
Makepeace
Cessford
GLEICHEN
C.N.R.
C.P.R.
Red Deer River
Gough Lake
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Figure 1. Location of Candidate Rumsey Ecological Reserve, Alberta.

[Scale 1:1 000 000 (from Provincial Base Map)]

FIGURE 2

RUMSEY ECOLOGICAL RESERVE

BEDROCK AND SURFICIAL GEOLOGY

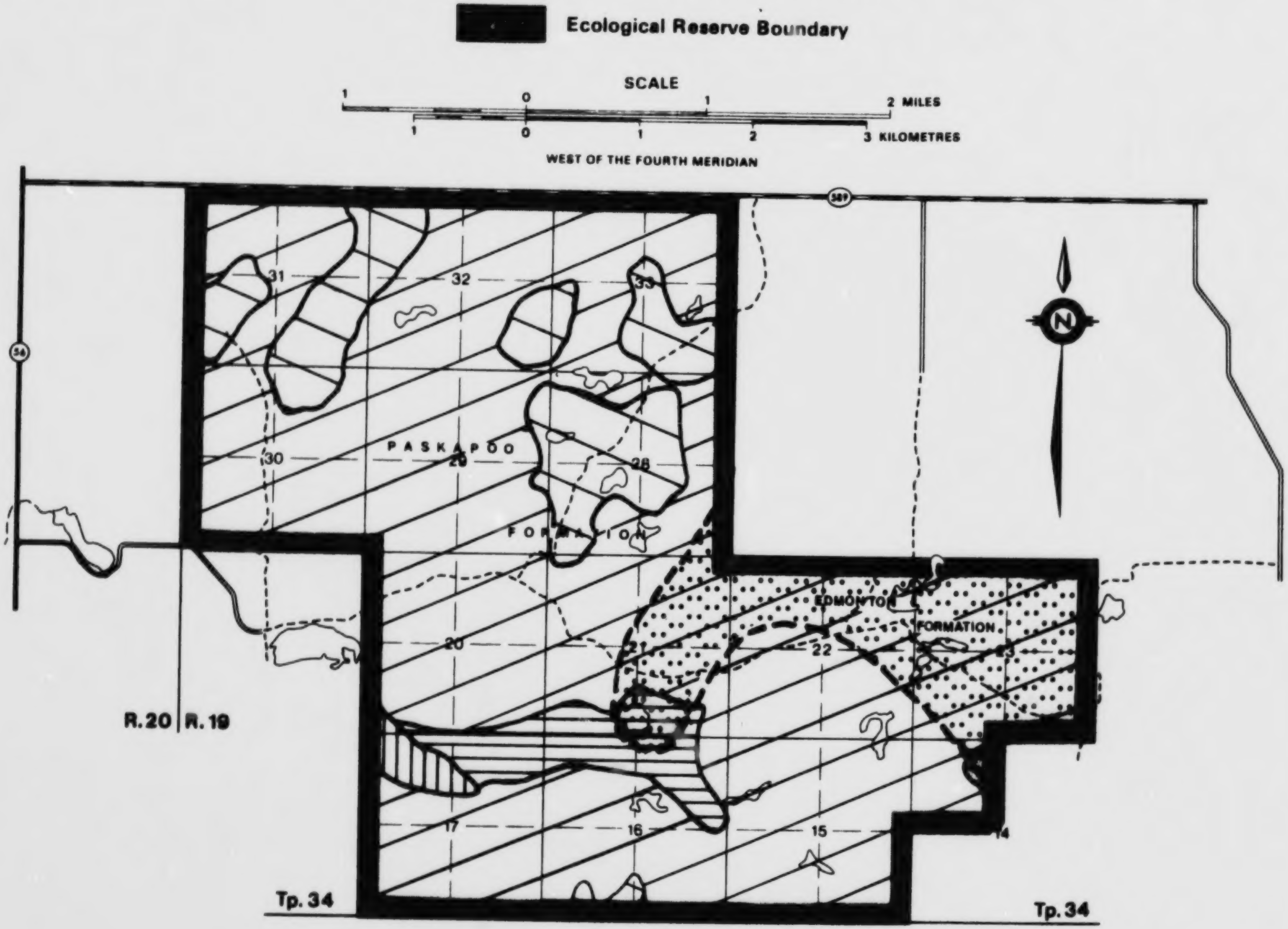

Ecological Reserve Boundary
SCALE
1
0
1
2 MILES
1
0
1
2
3 KILOMETRES
WEST OF THE FOURTH MERIDIAN
589
56
N
31
32
33
30
29
28
PASKAPOO
FORMATION
EDMONTON
FORMATION
20
21
22
23
17
16
15
14
R.20
R.19
Tp. 34
Tp. 34

Figure 2 BEDROCK AND SURFICIAL GEOLOGY

(after Bowser et al. 1951 and Stalker 1972)

LEGEND

Bedrock

░	Edmonton Formation
□	Paskapoo Formation

Surficial Deposits

▨	Hummocky Disintegration Moraine
▧	Moraine Plateau with Local Rim Ridges of Till
▥	Coarse Alluvium of Glacial Spillway
▤	Esker Complex

The highest hills in the reserve are called moraine plateaux. They are formed by the deposition of debris carried by streams into holes in stagnant glacial ice. Their surface is flat but some have one or two kettles on top. Clayey till is the major component of moraine plateaux but a layer of lacustrine silts and clays 0.6 to 3 metres deep covers the till in some places.

Alluvial deposits of sand and gravel form the outwash plain in Section 17. An esker and a complex of esker-like ridges are located immediately east and north of the alluvium.

Topography and Drainage

The knob and kettle terrain is typical of a hummocky disintegration moraine. The kettles are symmetrical, the knobs uniform in size and height, with the occasional depression in their centres, and moraine plateaux are present (Stalker 1972).

The reserve is considered hilly and strongly hummocky, though in Section 23 it is more rolling. Local relief is about 15 metres. The knobs are moderately steep with grades greater than 40%. Figure 2 is a topograpic representation of the area.

The bottom of the glacial spillway is about 846 metres above sea level (ASL). Moraine plateaux rise up to 884 metres ASL. Most sloughs occur between 854 and 861 metres ASL while the tops of most knobs are between 861 and 877 metres ASL.

Drainage in the reserve is poor as it is internal to the many sloughs in the kettles. Integrated drainage is developing very slowly because precipitation is low and the water standing in ponds evaporates or seeps into the ground. Many of the small sloughs are dry by mid-summer. On the alluvium, west of the esker, there is intermittant surface drainage. It is part of the Snake Lake drainage which eventually runs into the Red Deer River.

Soils

Although the reserve is underlain by both Paskapoo and Edmonton formations the parent material of the soil is glacial till of Edmonton formation origin (Bowser et al. 1951). The till is brown to grey-brown in colour, sandy in texture and has a low to medium calcium carbonate content.

The candidate ecological reserve is located on the north edge of the Dark Brown soil zone between the Thin Black and Brown soil zones. Climatic conditions (especially precipiation and evapotranspiration rates) and the vegetation of the Dark Brown soil zone are intermediate to those in the Thin Black and Brown zones, resulting in a soil of intermediate colour and depth (Bowser et al. 1951).

Principal soils in the reserves are loamy Dark Brown Chernozems found beneath grasslands and some aspen communities. The Hughenden loam, the principal Chernozem in the area, develops under native grass cover on well-drained, undulating to hilly topography. The average soil profile is described by Bowser et al. as follows:

Centimetres		
10	A1 -	Dark Brown, prismatic pH 7.0
8	A3 -	Brown to Dark Brown, prismatic pH 6.315
	B2 -	Strong Brown, prismatic to columnar, friable nuciform mesostructure, some staining in the cleavage lines
25	B3 -	Brown, friable with some vertical cleavage lines
	Cca -	At about 50 - 61 cm from the surface, low to medium lime
	C -	Brown, Sandy clay loam to clay till

Halkirk loam is another Chernozem found in the region of the reserve (although it has not yet been reported for the candidate reserve). This soil develops on more level land that is fairly well to well drained. The soil profile differs from the Hughenden loam by having a solodized solonetz (hard columnar pan) and a round topped B horizon.

Bowser et al. described the soils of depressions as podzols. Wroe (1971) further described them as Rego-Humic Gleysols. These soils are water saturated for most of the year and consequently have a muck surface and a heavy gleyed horizon. Runoff from the surrounding slopes carries organic and inorganic material into the depression. Water collects in the sloughs and gradually evaporates or seeps into the soil.

Black Chernozems are found under Populus tremuloides groves, although Wroe found the groves on Humic Gleysols as well.

The soils in the area are not considered suitable for cultivation due to either rough topography (90% of region) or excess water (10%). As pasturage it is rated as fair to good (Peters and Pettapiece 1970).

Twelve soil pits were dug during the course of the study. The soils compared favourably to those by Wroe. They are discussed further under the plant communities associated with them. Appendix 1 lists the soil profiles of the pits dug in 1982 and Appendix 2 shows the location of each pit.

Climate

The ecological reserve has a climate typical of continental areas in northern latitudes. The winters are long, cold and dry while the summers are short and moderately warm. Temperature extremes of less than minus 40° Celsius (C) and greater than 35° C are possible.

The prevailing winds are from the west and northwest although east and southeast winds are common. The reserve is on the northern edge of the warm Chinook winds. About twelve days in the winter months of January, February and March have temperatures greater than 4° C (Langley 1967).

The average annual precipitation in the aspen parkland in Alberta is 450 mm. The mean precipitataion for the months of May through to September is 300mm (Strong and Leggat 1981).

The reserve is in the subhumid moisture region of Canada (Sanderson 1948). There is little or no water surplus in any season due to low humidity, frequent high winds and low precipitation. Although the total summer precipitation is similar for both the aspen parkland and prairie regions, a greater percentage of it falls during July and August in the aspen parkland. This factor reduces moisture stress on vegetation and enables trees, such as *Populus tremuloides*, to grow (Strong and Leggat 1981).

The long-term averages at the Stettler and Trochu Equity meteorlogical stations (Figure 1) are listed below in Table 1. The stations are located 43 km north and 34 km southwest of the reserve, respectively.

Table 1. Climatic averages for the Stettler and Trochu Equity meteorologic stations 1951-1980 (Atmospheric Environment Service 1982).

	Stettler 52° 18'N,112° 42'W (823 m ASL)	Trochu Equity 51° 45'N, 113° 12'W (888 m ASL)
Mean Annual Temperature	2.5°C	2.9°C
Extreme Maximum Temperature	37.8°C	36.1°C
Extreme Minimum Temperature	-46.7°C	-43.0°C
Annual Precipitation	431.3 mm	400.8 mm
Annual Snowfall	108.8 mm	119.4 mm
Annual Rainfall	321.5 mm	281.4 mm
Length of Frost Free Period*	————	110 days
Annual Potential Evapotranspiration[a]	————	500 mm

* Alberta Ecological Survey (1979).

Vegetation

Moss (1932) described the aspen parkland as a transition or tension zone between the boreal forest and the prairie. He divided what is now known as the aspen parkland ecoregion into the poplar association and the grove belt. The grove belt consisted of aspen groves and patches of prairie grassland while the poplar association vegetation was predominantly poplar *Populus tremuloides* (aspen poplar). In the northern part of the region Moss (1932) felt *Picea glauca* (white spruce) was the climax species.

The aspen parkland has also been regarded as a subclimax ecotone between the coniferous forest and the prairie (Bird 1930). Coupland and Brayshaw (1953) described the parkland as an interspersion of forest communities in grassland; however, they considered the ecotone to exist around each *Populus tremuloides*.

Moss (1932) recognized the following two major vegetation types in the aspen parkland: the aspen community of moister and more sheltered sites, and the prairie complex of drier and more exposed sites. The prairie complex in Alberta was divided into the Northern and Southern prairie. They coincide roughly with the Brown and Dark Brown soil zone, respectively The grassland of the aspen parkland was described as Northern prairie with islands of Southern prairie throughout (Moss 1932). *Koeleria cristata* and *Festuca scabrella* (rough fescue) were the predominant Northern prairie species while *Agropyron* species, *Stipa* species and *Bouteloua gracilis* were important consituents of the Southern prairie.

The fescue grassland was not recognized as a distinctive vegetation type until recently. Moss (1932) was one of the first to recognize *Festuca scabrella* as an important grass of the parkland. It is now known to be a dominant grass in the parkland of central and southeastern Alberta, central Saskatchewan, Cypress Hill (Coupland and Brayshaw 1953; Moss 1955) and Glacier County, Montana (Lynch 1955). Coupland (1961) considered the fescue grassland as a separate association that required no further subdivision.

Wroe (1971) studied the fescue grassland in a near-pristine state in an area (NW 14-34-19-W4) that is now part of the candidate ecological reserve. He described eight plant community types on the basis of their dominant species. They are listed below as they occurred along a wet to dry moisture gradient:

1) *Carex atherodes* , in depressions,
2) *Salix petiolaris*, in moist locations, especially around sloughs,
3) *Populus tremuloides*, in areas around the *Salix* communities
4) *Symphoricarpos occidentalis*, within fescue grasslands,
5) *Festuca scabrella*, moist hillsides and level sites,
6) *Stipa spartea* var. *curtiseta* - *Festuca scabrella* on southerly aspects of hills,
7) *Stipa spartea* var. *curtiseta-Artemisia frigida* on the south exposure of hilltops, and
8) *Koeleria cristata-Agropyron smithii* on solenetz soils. Wroe found that livestock selectively grazed the hilltop and south slope community types.

History and Land Use

The original inhabitants of the aspen parkland were native Indians. They were nomadic people who hunted the abundant wildlife. Bison, wapiti, pronghorn, mule deer, white-tailed deer, furbearers and the occasional moose were found in the vicinity of the candidate ecological reserve. Indians used fire as a tool for modifying the movements of bison, their major food source, and for communicative purposes. Their use of fire probably had the greatest impact on the land (Wroe 1971).

Fur traders and bounty hunters, attracted to the area because of the abundance of wildlife, came out in the 17th and 18th centuries. In the late 1800's and early 1900's settlers moved into the area to homestead. By the late 1800's animals such as bison and wolf had disappeared. During the 1930's the influx of settlers abated but picked up again after World War II. By 1960 much of the native vegetation had been altered by livestock grazing or destroyed through cultivation (Bird and Bird 1967).

The Dominion of Canada legal land survey in the area was completed in 1907 by R.H. Cautley. Prior to 1907 the land in the reserve was grazed as open range by the Imperial Ranching Company, free of charge. Burns ranching interests purchased the grazing rights from the Imperial Ranching Co. in 1911 and introduced fencing. In 1917 Tom Usher and Jim Walters acquired the lease. They operated together until 1920 when the ranch was divided. Usher was granted grazing lease 33419 (Wroe 1971). In 1977 the Usher Ranching Ltd. had the lease renewed for a ten year period.

The reserve is included in the Usher's year-long rotational grazing system. The carrying capacity was set at 32 acres/head/year in 1920 and remained at that level until 1962 when it was lowered to 28 acres/head/year. The reserve has been grazed at stocking rates of 32 acres/head/year in 1947, 31 acres/head/year in 1967 and 26 and 34 acres/head/year in January and December, 1968 respectively (Bradley and Bradley 1977).

The northwest quarter of 14-34-19-W4 was removed from grazing lease 33419 in 1967 to be set aside as a Grassland Research Reserve for the Department of Lands and Forests and The University of Alberta. In 1971 a reservation with no dispositions allowed (RLC7) was requested by the Public Lands Division. The reservation was granted in 1973.

The Big Valley Pot Hole Development Project of Ducks Unlimited Canada was carried out in the late 1950's and early 1960's to improve waterfowl breeding habitat and to provide permanent stock water. Ditches were cut between sloughs in an attempt to create permanent waterbodies by draining several small sloughs into one. Five ditches were cut into the lands now included in the reserve; however, the sloughs rarely fill sufficiently to spill into the lower sloughs (Usher and Webster 1982, pers. comm.). The location of each ditch is shown in Figure 3.

In the mid 1970's an inventory of parks and natural areas suitable for recreation or preservation was undertaken by the Natural Areas Program of Public Lands, Alberta Energy and Natural Resources, and the Resource Assessment Group of Alberta Recreation and Parks. They found that of existing reserved areas in the province, less than 0.1% was aspen parkland, even though it is the most populated and accessible region in Alberta and contributes over 11% of Alberta's land area.

Areas that were representative of the region and large enough to withstand recreational use were sought. Three areas of 15 or more sections (totaling 135 sections) were found. The Rumsey Block was the largest (90 sections) and most representative. (The other two sites were the Neutral Hills and the Wainwright block). On the recommendation by Alberta Recreation and Parks, the Natural Areas Programs decided on an area of 3445 ha to be nominated as an ecological reserve. The area was nominated in 1979 and was reserved as a conservation area (RLC4) by Public Lands in 1980.

The Rumsey site was chosen for the following reasons (Alberta Ecological Survey 1979):

1. It is the only large relatively undisturbed area of aspen parkland on hummocky disintegration moraine left in Canada.
2. The moraine plateaux are not cultivated or overgrazed.
3. The fescue grasslands are unsurpassed in Alberta.
4. The saline, wet meadows in the glacial spillway are not overgrazed.
5. An ecological benchmark is present in NW 14-34-19-W4.
6. Rare and uncommon animal species inhabit the area.
7. It is within one grazing lease.
8. It includes some of the most spectacular hummocky disintegration moraine in the region.

METHODS

Flora and Vegetation

Most of the field research for this report was conducted during the months of May, June and July, 1982.

All plant species observed were identified or collected for later identification so that a floral list could be compiled. Floral lists from other studies on the reserve were used also. Voucher specimens were collected for verification and depositon in the herbaria of the Alberta Provincial Museum (PMAE) and Alberta Energy and Natural Resources. Nomenclature for the vascular plants follows Moss (1959).

The plant community types were described on the basis of vegetation surveys in the field. They were described by their dominant species. Community types that might be found in the area were ascertained by a literature search. Relatively homogenous stands of each community type were selected for study from false-colour infrared aerial photographs (scale=1:15,000) and from field inspections. Only about six communities of each community type could be surveyed due to time constraints. They were chosen to represent a variety of geographical positions. Community plots varied in size from 25m^2 to about 5 hectares. Most stands were inspected in mid-June and again in late July so that both early and late blooming species could be recorded.

An example of the stand description sheet used and the accompanying explanation sheet are included in Appendix 4. They are the standard forms used for plant community surveys by the Natural Areas Program.

Within each stand, canopy cover was estimated for each canopy layer and each species within a layer. The layers recognized were:

1. Tree layer
2. Tall shrub layer: woody plants 2 to 0.5 m tall
3. Low shrub layer: woody plants 0.5 to 2 m tall
4. Herb-dwarf shrub: woody plants less 0.5 m tall and all herbs
5. Bryoid layer: all mosses and lichens

Cover values were also estimated for rock, humus mineral soil, deadfall and water. Canopy cover (or just "cover") refers to the mean cover of a species or strata in each community type.

The following physical features were noted for each stand: elevation above sea level (ASL), landform, topographic position, slope, aspect, microtopography, moisture regime and soil class.

The area occupied by each community type was determined by measuring the proportion of each type along transects through the reserve in aerial photographs. Since the grassland community types could not be accurately delineated on the photographs they were treated together as grasslands. Symphoricarpos occidentalis stands were included under grasslands for the same reason. The transects were located along the road allowances bordering and crossing the reserve. 41.6 km of transects were measured on 1976 black and white photographs (Scale = 1:31,680) and also on more recent (1979) larger scale (1:15,000) false-colour infrared photographs.

The transects measured for this study were chosen to correspond to the transects Cautley surveyed in 1907 for the Dominion of Canada legal land survey. Since he measured the amount of wetland, grassland, willow (Salix spp.) and aspen poplar along each transect brush invasion of the grasslands was determined by comparing the percentage of brush on the transects in 1907 to that in 1979. The 1979 infrared photographs were used for comparison because it is possible to discern more detail is possible on them.

Fauna

Species lists were compiled for mammals, birds and reptiles and amphibians based on field observations and sightings from the area listed in other reports. Nomenclature for the mammals follows Banfield (1974), for birds Godfrey (1966) and for reptiles and amphibians Cook (1980).

Wildlife was usually observed and identified in the course of doing the vegetation field work. Bird surveys were undertaken several times during May, June and July, 1982. Particular habitats or areas were searched and all bird species seen were recorded. More structured surveys were conducted for waterfowl and deer. Lloyd Webster of Big Valley, Alberta was the foreman of the grazing lease for 40 years (1942-1982) in regards. During an interview he provided information about wildlife the reserve.

1. Deer Survey: Twice each week a 9.9 km trail between the south and north reserve boundaries (Appendix 6) was driven and the deer seen were recorded. The species, sex (where possible), habitat and behavior exhibited was recorded for each individual. Appendix 7 is an example of the date sheets used. One survey was done in the morning within three hours of first light and the other was completed at dusk within the last three shows of light. The survey was done in one direction only so that disturbance from the vehicle did not influence deer movement.

   The first survey was completed on May 11 and the last on August 24.

2. Waterfowl Survey: Waterfowl (i.e. ducks and geese) counts were done in spring on 46 potholes (Appendix 6). All sloughs in an area of the candidate reserve were surveyed. Each slough was surveyed twice, once in May and later again in June. The total number of indicated birds for the area surveyed was calculated using the method utilized by the Canadian Wildlife Service (Bruce Turner 1982, pers. comm.)

   The exact methods for determining the total number of indicated birds is in Appendix 9. The waterfowl species present and their relative abundance was established using the survey results.

Disturbed Sites

Disturbed areas were defined as sites that had been altered from their natural state by man. They were identified on aerial photographs, ground-truthed and then mapped. Disturbances found while doing field work were mapped as well. Lloyd Webster (1982, pers. comm.) was interviewed for further information.

Specal Features

Plants, animals and geographical features considered to have special importance were identified and mapped. Features were considered 'special' if they were rare or uncommon outside the candidate reserve or if they presented some other unusual aspect.

RESULTS AND DISCUSSION

Flora

The vascular flora of the candidate reserve consists presently of 291 species distributed among 49 Families and 158 Genera (Appendix 8).

Carex is represented by 16 species making it the most species-rich Genera. Other species-rich Genera include Potentilla (9), Agropyron (8) Astragalus (8), Ranuneulus (7) and Poa (6).

Gramineae and Compositae are represented by 49 and 51 species, respectively, making them the most species-rich Families in the candidate reserve. Other species-rich families include Cruciferae (19), Leguminosae (18), Rosaceae (18), Cyperaceae (21) and Ranunculaceae (12).

One species found in the reserve, Allium geyerii is considered rare in Alberta (Packer and Bradley 1978).

Vegetation

The knob and kettle terrain of the candidate reserve allows for a variety of microclimates, each of which supports a flora of different species composition and physiognomy.

Hydrophyllic community types are found in the depressions where water collects. Deep sloughs are ringed with Carex species Scolochloa festucacea, Beckmannia syzigachne, Eleocharis palustris and Typha latifolia. In shallow marshes open water is uncommon and the vegetation is dominated by Carex species, Poa palustris, Cirsium arvense, Scholochloa festucacea, Mentha arvensis and Hordeum jubatum. Along the margins of saline sloughs live salt tolerant species such as Scirpus paludosus, Puccinellia nuttalliana, Suaeda depressa, Distichlis stricta and Glaux maritima.

Willow (Salix spp.) stands occupy the banks of the sloughs. The tall willows form a dense canopy under which there is a sparse herb layer.

The wetland community types are under constant pressure from invading willows that ring the slough. Dry years allow willow stands to encroach into the slough; wet years drown the saplings and keep the willow stands in check.

Groves of Populus tremuloides generally occur around willow communities and on mesic north-facing slopes. They appear to be encroaching into the grasslands on the upper sections of north-facing slopes and on the lower sections of the south-facing slopes.

Two shrub community types are found in the reserve. Elaeagnus commutata - Symphoricarpos occidentalis is a minor type found in only a few locations, while Symphoricarpus occidentalis is found throughout the grasslands in mesic locations.

About three-quarters of the reserve is grassland. *Festuca scabrella* communities occur in dense stands over about half of the reserve on mesic sites, particularly on moraine plateau tops and on north-facing slopes. South-facing slopes and crests are more xeric than the slopes of northerly aspect and are vegetated with community types dominated by *Stipa spartea* var. *curtiseta*, *Artemisia frigida* and *Bouteloua gracilis*.

Two grasslands of minor distribution are found within the reserve. *Koeleria cristata* - *Agropyron smithii* occur on solonetz soils on lower slopes and level areas (Wroe 1971). *Agrostis scabra* - *Achillea millefolium* - *Antennaria nitida* communities are found in shallow depressions on the tops of moraine plateaux.

The NW quarter of section 14-34-19-W4, has not been grazed since 1970 (Wroe 1971). A few differences were noted between grazed and ungrazed fescue grasslands. Most noticeable was the dense grass and humus of the ungrazed area. In parts of the ungrazed area the fescue grass was matted down from precipition and appeared to be unable to right itself. Also, the grassland was not broken by heavily grazed areas. *Bouteloua* - *Artemisia* stands were not noted in this quarter section, although the lack of grazing may just have made these stands less noticeable.

Canopy cover of species and community strata in this quarter section are comparable to those in the rest of the candidate reserve.

1. Community Types

The vegetation of the reserve is broken down into community types based on the dominant species in a stand. Only homogenous stands were inspected and described.

Twelve communities are recognized. Seven of the community types were also described by Wroe (1971). The community types corresponding to Wroe's breakdown are:

1. *Populus tremuloides*,
2. *Salix petiolaris*,
3. *Symphoricarpos occidentalis*,
4. *Festuca scabrella*,
5. *Stipa spartea* var. *curtiseta* - *Festuca scabrella*
6. *Stipa spartea* var. *curtiseta* - *Artemisia figida*, and
7. *Koeleria cristata* - *Agropyron smithii*.

The *Carex atherdoes* community type, described by Wroe, is separated into *Carex atherodes* - *Scolochloa festucacea* - *Eleocharis palustris* - *Typha latifolia* and *Carex atherodes* - *Scolochloa festucacea* - *Poa palustris* - *Cirsium arvense* community types. The saline wetland stands are described as *Scirpus paludosus* - *Puccinellia nuttalliana* - *Hordeum jubatum* - *Distichlis stricta*.

Bouteloua gracilis - *Artemisia frigida* and *Agrostis scabra* - *Achillea millefolium* - *Antennaria nitida* community types are also found in the reserve.

Canopy covers are listed in Appendix 9.

a. Carex atherodes - Scolochloa festucacea - Eleocharis palustris Typha latifolia Community Type

This community type occupies the subhydric and hydric margins of relatively deep freshwater sloughs (854-861m ASL). Water accounts for 13% of the basal cover. Drainage is very poor.

The perimeter of most sloughs in the reserve are vegetated with Carex - Scolochloa - Eleocharis - Typha. Five communities were inspected.

The co-dominants Carex atherodes (37.0% canopy cover) and Scolochloa festucacea (33.0%) are common to the wet meadow community type (Carex - Scholochloa - Poa - Cirsium); however, the abundance of Eleocharis palustris (19.6%) and Typha latifolia (12.2%) is a distinguishing feature. Stands of this type are more hydrophyllic and less extensive than the wet meadow stands. Other species characteristic of the stands are Alopecurus aequalis (12.0%), Rumex maritimus (11.8%), Glyceria grandis (8.0%) and Beckmannia syzigachne (6.6%). Canopy cover of the herb-dwarf shrub layer is 94% (90-95%).

The low shrub, Salix petiolaris, is a minor constituent in two communities.

b. Carex atherodes - Scolochloa festucacea - Poa palustris Cirsium arvense Community Type.

This community type occurs in hygric and subhydric (plus one stand in mesic) depressions (846-869 m ASL). The basal cover of water is 16.3%. Soils are imperfectly to very poorly drained Rego Humic Gleysols. Except for some of the deep marshes, these sloughs dry up by mid-summer.

These wet meadow stands are prevalent in the kettle bottoms and valleys. Seven stands were examined. There is little open standing water in these communities; however, water is present amongst some of the vegetation.

Carex atherodes has a canopy cover of 35.0% and Scolochloa festucacea 30.7%. Poa palustris accounts for 20.7% of the canopy cover while the cover of Cirsuim arvense is 19.0%. Potentilla anserina (7.9%), Mentha arvensis (7.0%) and Hordeum jubatum (6.9%) are other species characteristic of this community type. The herb-dwarf shrub layer has 95% (85-99%) canopy cover.

The canopy covers of hydrophyllic species are lower in this community type than in Carex - Scolochloa - Eleocharis - Typha. For example, in the latter community type the canopy cover of Eleocharis palustris is 19.6% compared to 1.4% in the wet meadow stands. The cover of Glyceria grandis is 8.0% versus 1.4% and 12.0% versus 0.01% for Alopecurus aequalis. Hydrophylls, such as Rumex maritimus, Scirpus acutus, Scirpus validus and Typha latifolia, present in Carex - Scolochloa - Eleocharis - Typha, do not occur in the wet meadow.

Shrub canopy II consists of a few Salix petiolaris, Populus tremuloides and Rosa woodsii saplings that have less than 1% canopy cover. During dry periods Salix petiolaris, and to a lesser extend Populus tremuloides, invades this community type only to die back when a wet period returns.

Some of the larger stands are cut in the summer for winter livestock feed by the Usher Ranching Co.

c. *Scirpus paludosus* - *Puccinellia nuttalliana* - *Hordeum jubatum* - *Distichlis stricta* Community Type.

This community type occupies subhydric saline depressions (861 m ASL). Water contributes an average of 20% (5-35%) of the basal cover.

This community type occurs in a wide band around saline sloughs. Each of the dominant species occupy a particular location along a moisture gardient within the stand and could probably be called a separate community type (Dodd and Coupland 1961). Since only three stands were inspected they are treated as one community type.

The herb-dwarf shrub canopy cover is 64% (42-75%). *Scirpus paludosus* (38.3% canopy cover) is dominant and forms the inner most band of vegetation. *Puccinellia nuttaliana* (25.0%) surrounds *S. paludosus* and in turn is ringed by *Hordeum jubatum* (21.7%). *Distichlis stricta* (18.4%) occupies the drier upland. Other characteristic species include *Eleocharis palustris* (10.3%) *Scirpus americana* (6.7%), *Glaux maritima* (6.0%) and *Juncus balticus* (6.0%).

Salix petiolaris, *Populus tremuloides* and *Populus balsamifera* are found in shrub layer II but they have less than 1% canopy cover.

d. *Salix petiolaris* Community Type

Salix petiolaris occurs under a mesic to hygric moisture regime in depressions (854-877 m ASL). The soils are moderately well to poorly drained Rego and Orthic Humic Gleysols.

Salix petiolaris is a fairly stable community type that occupies moist banks around sloughs and mesic depressions. The stands are usually surrounded, to varying degrees, by *Populus tremuloides*. Sometimes individual *Salix* plants are found on north-facing slopes or in hollows on level areas.

The dominant species is *Salix petiolaris* with a mean canopy cover of 60.0%. This species along with *Salix bebbiana* (6.0% canopy cover), forms a tall dense shrub layer (I) with a total canopy cover of 63% (15-95%).

The tree canopy is well developed in two (D4 and D6) of the six stands inspected. Mean tree cover is 25% (0.1-85%). *Salix bebbiana* is dominant (19.0%); however, *Salix lutea* (5.0%), *Populus balsamifera* (0.2%) and *Populus tremuloides* (0.5%) are sometimes present.

A thin cover of low shrub is found beneath the tall shrubs and trees. Low shrub cover is 16% (6-30%). *Rosa woodsii* (90.0%) is dominant; however, the shrubs *Amelanchier alnifolia* (5.9%), *Symphoricarpos occidentalis* (5.7%) and *P. tremuloides* (1.3%) are also present.

The herb-dwarf shrub layer has a canopy cover of 33% (10-50%). Species characteristic of this layer are: Sonchus species (10.3%), Poa palustris (8.8%), Epilobium angustifolium (7.7%), Potentilla anserina (6.0%) and Anenome canadensis (5.4%).

The presence of living and dead willows in the Carex communities suggests that the willows expand into the meadows during dry seasons and die back when wetter conditions prevail.

e. Populus tremuloides Community Type

Populus tremuloides communities occupy depressions and gradual to moderately steep slopes (5° to 30°) of northerly aspect. Some stands are found on slopes with a southerly aspect. The sites are submesic to subhygric at an elevation between 846 and 877 m ASL. Soils are moderately well drained Black Chernozems and Humic Gleysols.

The aspen poplar community type is a slow changing to stable community. It is the only community type dominated by trees. Stands burned in 1981 and the edges of established stands are changing at a slow to moderate rate. Wroe (1971) found that the groves in his study area (NW 14-34-19-W4) ranged from 0.02 to 0.05 hectares.

Most stands are located on north slopes or form an incomplete ring around willow-edged sloughs, but it appears that the communities are encroaching into the grassland on west, east and south-facing slopes. Aspen and poplar invasion of grasslands is discussed below.

Six stands were examined. Unlike Wroe, who separated the groves into young and mature stands, only homogenous areas of the grove were inspected. The edges where aspen poplar groves are invading grasslands were avoided.

The tree canopy of P. tremuloides is well developed with a mean canopy cover of 62% (10-85%). No other tree species was recorded. Average tree height is 9.3 (5-16)m high while the diameter at breast height average is 32.8 (6.8-104.0)cm. In one (E2) of the six stands examined P. tremuloides forms a second tree canopy with 15% canopy cover. A tall shrub layer composed of P. tremuloides (10% canopy cover) and Amelanchier alnifolia (1%) is found in one (E5) community. Its canopy cover is 11%.

Total canopy cover for shrub layer II is 63% (30-90%). The well-developed low shrub strata is dominated by Symphoricarpos occidentalis (29.0%) and Rosa woodsii (24.0%). Other shrubs include Rubus strigosus (6.7%), Ribes oxyacanthoides (3.3%) and Amelanchier alnifolia (1.7%).

The herb-dwarf shrub strata averages 49% (20-75%) canopy cover. The dominant species of this layer are: Galuim boreale (6.8%), Epilobium angustifolium (5.0%), Hackelia americana (4.7%), and Vicia americana and Carex praticola, both with 4.3% canopy cover.

The burned stand (E6) , with 37 species, has the greatest number of species. The stand with the next highest number of species is E4 with 29. Stand E2 is the most mature stand but is composed of only 18 species, about half the number of species in the burned stand. The tree canopy cover of the burned stand is only 10%, compared to the mean of 62%. The low shrub layer is well developed in the burned stand. Its cover was 85% compared to the mean of 63%.

f. *Symphoricarpos occidentalis* Community Type

The *Symphoricarpos occidentalis* community type is found on subxeric to mesic sites in fescue grasslands at 846 to 869 metres ASL. It occurs primarily on middle and lower slopes (3° to 38°), most of which are south-or west-facing, or in shallow depressions on level areas. The Dark Brown and Black (Wroe 1971) Chernozems are well to moderately well drained.

The *Symphoricarpos occidentalis* community type is a dense, closed shrubland that is normally located in *Festuca scabrella* grasslands. Wroe (1971) described this community type as a shrub dominanted grassland and found the stands varied from 0.004 to 0.30 hectares in size.

Total canopy cover for shrub layer II is 85% (75-97%). *S. occidentalis* is the dominant plant with 78.0% cover. *Rosa woodsii* (10.5% canopy cover) and *Ribes oxyacanthoides* (0.2%) are also present.

Herb-dwarf shrub cover is 35% (15-45%). Dominant plants in this layer are *Carex praticola* (8.3%), *F. scabrella* and *Artemisia ludoviciana* (the latter two with 5.0% cover). Other plants characteristic of this community type incude *Galium boreale* (4.5%), *Agropyron subsecundum* (3.2%) and *Cirsium arvense* (3.0%).

Where communities of this type occur next to willow and aspen poplar communities, it was observed that willow and aspen poplar saplings are establishing themselves in some of the *S. occidentalis* stands. The six stands examined are stable or slowly changing.

g. *Elaeagnus commutata* - *Symphoricarpos occidentalis* Community Type

This is a community type of mesic to submesic middle and lower slopes (854-861 m ASL). The stands are moderately well to well drained and occupy slopes of northerly and southerly aspects.

This is a minor community type in the reserve. Three of the four stands seen in the candidate reserve were examined.

Elaeagnus - *Symphoricarpos* is probably a successional shrub community-type, the climax dominant being *Populus tremuloides*; however, the communities are encroaching into the grasslands and there are no signs of *P. tremuloides* becoming established. The communities are widely separated and occur in small discrete stands.

The shrub layers are well-developed and dense. The dominant species, *Elaeagnus commutata*, forms shrub layer I in one stand (G3) and shrub layer II in the other two stands. Its mean canopy cover is 50.0%. Dominating the underbrush beneath *E. commutata* is *Symphoricarpos occidentalis* with 48.0% canopy cover. Another shrub characteristic of shrub canopy II is *Rosa woodsii* (26.7% canopy cover). The canopy cover for shrub layers I and II is 16.7% (0-50%) and 80% (48-99%), respectively.

The herb-dwarf shrub layer is poorly developed. Its canopy cover is 18% (5-40%). Characteristic herbs include *Hackelia americana* (6.7%), *Galium boreale* (5.3%) and *Rorippa islandica* (5.0%).

When these stands expand into the grassland it was observed that *E. commutata* is the first to establish, followed by herbs and finally *S. occidentalis* and *R. woodsii*.

Bradley and Bradley (1977) considered *E. commutata* to be more abundant as one goes south of the reserve.

h. *Festuca scabrella* Community Type

Festuca scabrella communities occupy subxeric to submesic sites on level areas or on gentle (5°) to strong (25°) slopes of northerly or southerly aspect. They vary in elevation from 861 to 877 m ASL. The Dark Brown, and occasional Black Chernozem (Wroe 1971), soils are well to moderately well drained.

The *Festuca scabrella* grassland is a stable grassland and the predominant community type in the reserve. Seven stands were inspected. This grassland occupies sites on the moisture gradient between the mesic communities of the kettles and the *Stipa* dominated communities of the hillsides.

The communities are dominated by *F. scabrella* which has a canopy cover of 79% (60-90%). The *F. scabrella* is tall, lush and interspersed amongst a thick layer of humus. *Galium boreale*, the subdominant, has the next highest canopy cover with 10%. Other species present and characteristic are: *Anenome patens* (5.1% canopy cover), *Artemisia ludoviciana* (4.4%) and *Agropyron subsecundum* (4.0%) The canopy cover for the herb-dwarf shrub layer is 93% (80-99%).

The shrub, *Symphoricarpos occidentalis*, has a canopy cover of 5.3%, but since their average height is less than 0.5 metres it is placed in the herb-dwarf shrub layer. Four of the *Festuca scabrella* communities have *S. occidentalis* as one of their constituents.

Grazing is light on most of the large stands of fescue grassland. Occasionally, small areas are grazed intensively while the adjacent grass is untouched. Stands of suitable size and topography are hayed in the summer. Haying of a particular stand occurs once every 4 or 5 years (Usher and Webster 1982, pers. comm.).

i. *Stipa spartea* var. *curtiseta* - *Festuca scabrella* Community Type

This community type is found on xeric and subxeric sites on gentle (5°) to strong (20°) slopes of southerly, south-westerly and south-easterly aspect. The soils beneath this community type are rapidly to moderately well drained Dark Brown Chernozems. Communities of *Stipa spartea* var. *curtiseta* - *Festuca scabrella* are found at elevations between 861 and 884 m ASL.

The herb-dwarf shrub canopy cover is 84% (75-90%), compared to 93% cover in the more mesic *Festuca* communities. According to Wroe (1971), the stands range in size from 0.04 hectares to 0.8 hectares.

The co-dominants, Stipa spartea var. curtiseta and Festuca scabrella both have canopy cover values of 29.0%. Atremisia frigida (15.0% canopy cover), Anenome patens (5.2%), Koeleria cristata (3.2%), Poa secunda (3.0%) and Erigeron caespitosus (3.0%) are also important constituents.

This community type appears to be stable and is more heavily grazed than the fescue grassland that is normally adjacent to it.

j. Stipa spartea var. curtiseta - Artemisia frigida Community Type

The Stipa - Artemisia community type is confined to xerix and subxeric sites on the crests and upper slopes (11° to 25°) of knobs at elevations between 854 and 869 m ASL. The stands are on the south-facing slopes. Soils are rapidly and well drained Dark Brown Chernozems.

The herb-dwarf shrub layer is well developed with Stipa spartea var. curtiseta (45.0% canopy cover) and Artemisia frigida (26.7%) dominant. Other species of importance are Selaginella densa (18.3%), Festuca scabrella (8.3%) and Thermopsis rhombifolia (6.7%). Species which have low cover but occur frequently are Bouteloua gracilis, Koeleria cristata, Anenome patens, and Vicia sparsifolia. Total herb-dwarf shrub cover is 87% (70-95).

The only woody plant recorded was Rosa arkansana with 3.7% canopy cover.

The size of the Stipa - Artemisia stands range from 0.008 ha to 0.16 ha (Wroe 1971).

k. Bouteloua gracilis - Artemisia frigida Community Type

Communities of this type typically occupy xeric and subxeric sites at elevations between 846 and 869 metres. The sites are rapidly and well drained crests and upper and middle slopes (20-35°) of southerly aspect. The soils are Dark Brown Chernozems. One (K4) of the six stands inspected is atypical, being on a near level (2°), west-facing alluvium.

Canopy cover of Bouteloua gracilis, the dominant species, is 35.0%, followed by Artemisia frigida with 16.7%, Koeleria cristata with 12.7% and Stipa spartea var. curtiseta with 7.0%. Antennaria nitida, Chrysopsis villosa, Comandra pallida; Haplopappus spinulosus, Lygodesmia juncea and Thermopsis rhombifolia occur frequently but with low cover.

Rosa arkansana and Rosa woodsii are important constituents of the herb-dwarf shrub layer with canopy covers of 2.5% and 4.7% respectively.

The stand located on the outwash plain (K4) has a few species unique to it, such as Oenothera nuttallii, Orthrocarpus luteus and Solanum trifolium, but otherwise the flora is typical for this community type.

The Bouteloua - Artemisia community type is found under drier condition than the Festuca or Stipa - Festuca grasslands. The herb-dwarf shrub canopy cover at 78% (60-95%) is lower than that for the latter two. The humus also appears to be thinner. These differences are probably due to the drier conditions under which Bouteloua - Artemisia lives and to the heavier grazing pressure that they are subject to

Bouteloua - Artemisia is similar to the Stipa - Artemisia stands described in this report and by Wroe (1971). They occupy similar sites, are grazed fairly heavily and have several important species in common. The species include A. frigida, B. gracilis, S. spartea var. curtiseta, K. cristata, A. nitida, C. villosa and Poa secunda. This suggests that Bouteloua - Artemisia stands may be a disclimax community type created by the grazing of Stipa - Artemisia stands.

Grazing may discriminate against S. spartea var. curtiseta which is a 'decreaser grass species', and allows the 'increaser', B. gracilis, to predominate (Johnston et al. 1981). The cover of Stipa in Stipa - Artemisia stands averags 54.0% compared to 7.0% in Bouteloua - Artemisia stands while B. gracilis is 5.7% in the former and 35% in the latter. A. frigida canopy cover is 16.7% and 26.7% in Bouteloua - Artemisia and Stipa - Artemisia, respectively. K. cristata also increases under grazing. Its cover is 4.3% in the Stipa - Artemisia stands and 12.7% in Bouteloua - Artemisia stands.

Changes in species composition have been documented in communities under grazing pressure. On the Canadian prairies Coupland (1961) noted that, when the Stipa spartea var. curtiseta - Agropyron dasystachyum community type was grazed heavily it developed into a Stipa - Bouteloua or a Stipa - Bouteloua - Agropyron type and, if the grazing was prolonged, it developed into a Bouteloua - Stipa type. Bailey (1968) described a community type, which he named Stipa - Bouteloua, in the north Central Parkland of Alberta. Wheeler (1976) speculated it may be formed by the grazing of Stipa - Festuca stands on south-facing slopes. He also suggested that Stipa - Artemisia are disclimax communities formed in areas disturbed by grazing Bouteloua - Artemisia stands may form when Stipa - Artemisia stands are heavily grazed. Further, Stipa - Artemisia communities may have developed from the overgrazing of Stipa - Festuca stands.

l. Koeleria cristata - Agropyron smithii Community Type

This communty type occupies xeric sites on level areas and lower slopes. The soils are Brown Solonetz on the slopes and Black Solonetz in lower areas (Wroe 1971).

Koeleria - Agropyron is a minor community type of the reserve. According to Wroe (1971), it is characterized by a high cover of Koeleria cristata (59%) and Agropyron smithii (46%). Other important species are: Selaginella densa (59%), Carex eleocharis (35%), Poa secunda (15%) Grindelia squarrosa (15%) and Distichlis stricta (8%).

m. Agrostis scabra - Achillea millefolium - Antennaria nitida Community Type

This community type occurs in shallow, subxeric to submesic depressions on moraine plateaux (877 m ASL). The soils are moderately well to imperfectly drained Dark Brown Chernozem. The moisture regime of each stand varies considerably.

Agrostis - *Achillea* - *Antennaria* is a minor community type; only two stands were examined. It is restricted to moraine plateau hilltops. *Agrostis scabra* is the dominant species with a mean canopy cover of 23%. The two co-subdominants, *Achillea millefolium* and *Antennaria nitida*, both have canopy covers of 15%. Plants of both xeric and mesic sites are found in this community type. Characteristic plants of dry areas include *A. nitida*, *Bouteloua gracilis* (2.5% canopy cover) and *Koeleria cristata* (2.5%). Plants found in mesic areas are *A. scabra* and *Galium boreale* (7.6%). Total herb-dwarf shrub cover is 83% (75 and 90%).

2. Area of each Community Type

Grasslands constitute an estimated three quarters of the reserve. Based on the 1979 transects, 72.5% of the candidate reserve is grassland. Using a planimeter, Wroe calculated that 73.0% of his study area (NW 14-34-19-W4) was grassland. Table 2 lists the percentage of grassland, willow (*Salix* spp.), aspen poplar and wetland in 1971, 1976 and 1979. The percentage of each vegetation type along the 1976 transects are similar to those in 1979 and to Wroe's figures, and are therefore, not discussed at length but are provided for reference in Table 2.

Table 2. Percentage of the candidate reserve occupied by each vegetation type in 1907, 1971, 1976 and 1979 based on transect measurements

	Year				Difference between
Vegetation Type	1907[a]	1971[b]	1976[c]	1979[d]	1907 and 1979
Grassland	88.0	73.0	77.6	72.5	-15.5
Aspen poplar	0.2	9.1	8.9	15.3	+15.1
Willow	4.8	6.8	7.4	6.9	+ 2.1
Wetlands	7.0	11.1	6.2	5.3	- 1.7

a. Results of Dominion of Canada legal land survey (after Cautley 1907).
b. Planimetry results of NW 14-34-19-W4 (after Wroe 1971).
c. From transects on 1976 black and white aerial photographs.
d. From transects on 1979 false-colour infrared aeral photographs.

Wroe determined the area of each grassland community type in the quarter section. *Festuca scabrella* stands covered half (50.9%) of the area. *Stipa* - *Festuca* accounted for 11.0% and *Stipa* - *Artemisia* 2.3%. Only 0.5% of the study area supported *Koeleria* - *Agropyron* stands and 8.3% supported *Symphoricarpos occidentalis* communities. These proportions should be extrapolated to the candidate reserve with caution because the amount of brush is not distributed evenly throughout and additional community types are recognized. *Agrostis* - *Achillea* - *Antennaria* is probably found in a proportion similar to that of *Koeleria* - *Agropyron*, while *Stipa* - *Festuca*, *Stipa* - *Artemisia* and *Bouteloua* - *Artemisia* occupy an area similar in size to the two *Stipa* communities of Wroe's study (i.e. between 2% and 11%). *Festuca scabrella* may constitute less than half the area now due to brush invasion and grazing.

Salix petiolaris stands covered 6.9% of the land in 1979. Wroe's measurement of the cover was 6.8%.

According to the 1979 photographs about 5.3% of the candidate reserve is wetland. Ponds, (i.e. sloughs with open water in the centre) occupy 3.1% of the land along the 1979 transects. Approximately 2.2% of the reserve is wet meadow. *Carex* - *Scolochloa* - *Poa* - *Cirsium* is found in the wet meadows. The margins of the ponds support *Carex* - *Scolochloa* - *Eleocharis* - *Typha*. In NW 14-34-19-W4 *Carex atherodes* stands occupy 11.1% of the land (Wroe 1971).

According to the 1979 transects, the area covered by aspen poplar is estimated to be 15.3% In Wroe's study area 9.1% was covered by aspen poplar. This figure differs greatly from the 1979 transects but is similar to the 8.9% obtained from the 1976 photographs. Since aspen poplar stands have been encroaching into grasslands (Bailey and Wroe 1974) it is plausible that the percentage of the grassland in the reserve is now closer to 15% than 9%.

3. Brush Invasion of the Grassland

Bailey and Wroe (1974) measured brush cover along randomly selected transects from the Dominion of Canada legal land survey field notes of Cautley (1907) and compared them to the same transects on 1966 aerial photographs. All transects were within 34-19-W4. They found that brush cover increased by 3.2% during the 59 year period from 1907 to 1966. In 1966, 88% of the 40 one-mile transects crossed aspen groves while in 1907 only two groves were crossed. The annual rate of brush cover was 0.05%.

A similar study for this report compared the 1907 transects in the candidate reserve to the same transects on 1979 aerial photographs. The major difference between 1907 and 1979 was the dramatic increase of aspen poplar by 15% and a corresponding 15% decrease in grassland. The former increased from less than 1% of the reserve in 1907 to just over 15% in 1979. Grassland decreased from 88% in 1907 to 73% in 1979. The annual rate of aspen invasion during the 72 year period was 0.21%.

The total slough area dropped from 7.0% to 5.3% while willow stands increased 2.1% to 6.9%. It is possible that the change in wetland and willow area is due to fluctuations in the water table. Differences in defining the waterline may account for some of the fluctuation.

It was originally thought that the supression of fires by settlers, and the extermination of bison in the late 1800's permitted aspen poplar encroachment into the grassland; however, settlement of Western Canada coincided with a drought in the late 1800's (Raby 1966) and many aspen poplar groves were probably burned by the frequent fires. It appears that moister and cooler climatic conditions prevailed in the early 1800's enabling aspen poplar groves to expand. Moss (1932) noted that modified Black Chernozems (soils developed under grasslands) were found under the aspen groves, indicating that invasion into the grasslands was fairly recent. The oldest aspen stand found by Moss was estimated to have been established in 1818, before bison vanished or settlers appeared. It was noted by early travellers that Indians used fire to control forest expansion and decrease grass fire danger in the summer (Raby 1966) but it is unlikely that they changed their customs in the early 1800's and thereby allowing forest expansion. In a study in Minnesota Buell and Cantlon (1951) concluded that the rapid expansion of maple-basswood stands since 1810 was due to climatic change. In Montana, Lynch (1955) reported the grassland-forest ecotone was stable, due primarily to the distribution of precipitation, and secondarily to biotic factors. Fires were uncommon and deemed unimportant in maintaining the grassland.

The cause of aspen poplar expansion into grassland is an important question in the management of the ecological reserve and merits further study.

Fauna

The candidate reserve enocompasses a variety of wildlife habitats. The major habitats are wetland, shrubland, aspen poplar groves and disturbed and undisturbed grassland. Due to extensive habitat destruction in the parkland this area is important as a refugium for wildlife.

The location of some of the animals observed are presented in Figure 4.

1. Birds

Seventy bird species were identified in the candidate reserve during the spring and summer. Another eleven species were reported in the area by Bradley and Bradley (1977). Appendix 10 is an annotated list of the birds. The sloughs are rich in birdlife. Eleven species of shorebirds were observed including Killdeer, Wilson's snipe, Willet, Avocet, Wilson's Phalarope and Spotted Sandpiper.

The total number of ducks and geese indicated by the waterfowl survey was 399. Eleven species were observed (Appendix II). 90% of the birds were puddle ducks, 9% diving ducks and 1% Canada Geese. Blue-winged Teals were the most abundant puddle duck and waterfowl species. They accounted for 21.6% of the birds. Mallards (15.8%), Gadwalls (15.5%), Green-winged Teals (13.0%), American Wigeon (11.0) and Shovellers (10.0%) were also abundant. Pintails (3.0%) were uncommon. The most common diving ducks were Lesser Scaups; they accounted for 6.5% of all waterfowl seen. Redheads (1.8%) and Canvasbacks (0.8%) were found on only two sloughs.

All species, except Redheads and Canvasbacks, were resident during the summer and are believed to have nested in the area in 1982. The small pot holes, typical of the candidate reserve, are most suitable for puddle ducks. 85% of the sloughs suppported puddle ducks while only 9% supported diving ducks.

Several Canada Geese were seen flying over the area at various times during the spring and four individuals were seen on slough #35 (Appendix 5) twice during the summer. One pair nested in a tree in the candidate reserve in 1982 (Chick 1982, pers. comm.). Their success rate is unknown.

Many of the sloughs surveyed subsequently dried up: Surveys were not done to determine the effect this had on brood production.

Coots were conspicuously absent, although there was an abundance of suitable habitat. They were reported for this area by Bradley and Bradley (1977) and, according to Webster (1982, pers. comm.), they are usually abundant.

The sloughs also supported Horned Grebes, Marsh Hawks, Sora Rails, Ring-billed Gulls, Franklin's Gulls, Black Terns, Yellow-headed Blackbirds, Red-winged Blackbirds and Le Conte's Sparrows.

The woodlands were separated into shrubland and aspen groves. Hairy Woodpeckers, Tree Swallows, Black-capped Chickadees, American Robins, Red-eyed Vireos, Black and White Warblers, Northern Orioles and White-crowned Sparrows were observed in aspen poplar groves only. Shrubland species seen were: Eastern Kingbirds, Least Flycatchers, Catbirds and Warbling Vireos. The following species were found in both aspen and willow stands: Ruffed Grouse, House Wrens, Cedar Waxwings, Yellow Warblers, American Goldfinches and Chipping Sparrows.

Disturbed and undisturbed grassland habitats were recognized. These habitats correspond to the breakdown of fescue grassland habitats by Owens and Myres (1972). Grassland disturbances were due to grazing and mowing. Patches of Symphoricarpos occidentalis, Rosa woodsii and Elaeagnus commutata shrubs were distributed throughout both habitats.

Habitat utilization by grassland passerines observed in the candidate reserve were similar to observations made by Owens and Myres (1972). Sprague's Pipets and Baird's Sparrows, the latter reported by Bradley and Bradley (1977), were both recorded in undisturbed or lightly grazed areas. In contrast Horned Larks were found in heavily grazed areas and along the vehicle trails. Savannah sparrows, Vesper Sparrows and Clay-Colored Sparrows were found in both disturbed and undisturbed areas, usually in association with shrubs.

Other species found on the grasslands include Sharp-tailed Grouse, Upland Sandpiper, Short-eared Owl and Brown-headed Cowbird.

Species such as the Red-tailed Hawk, Merlin, Black-billed Magpie and Common Crow utilized most of the habitats for either foraging or nesting.

The Starling and English House Sparrow, two introduced species in Alberta, were not observed in the candidate reserve.

2. Mammals

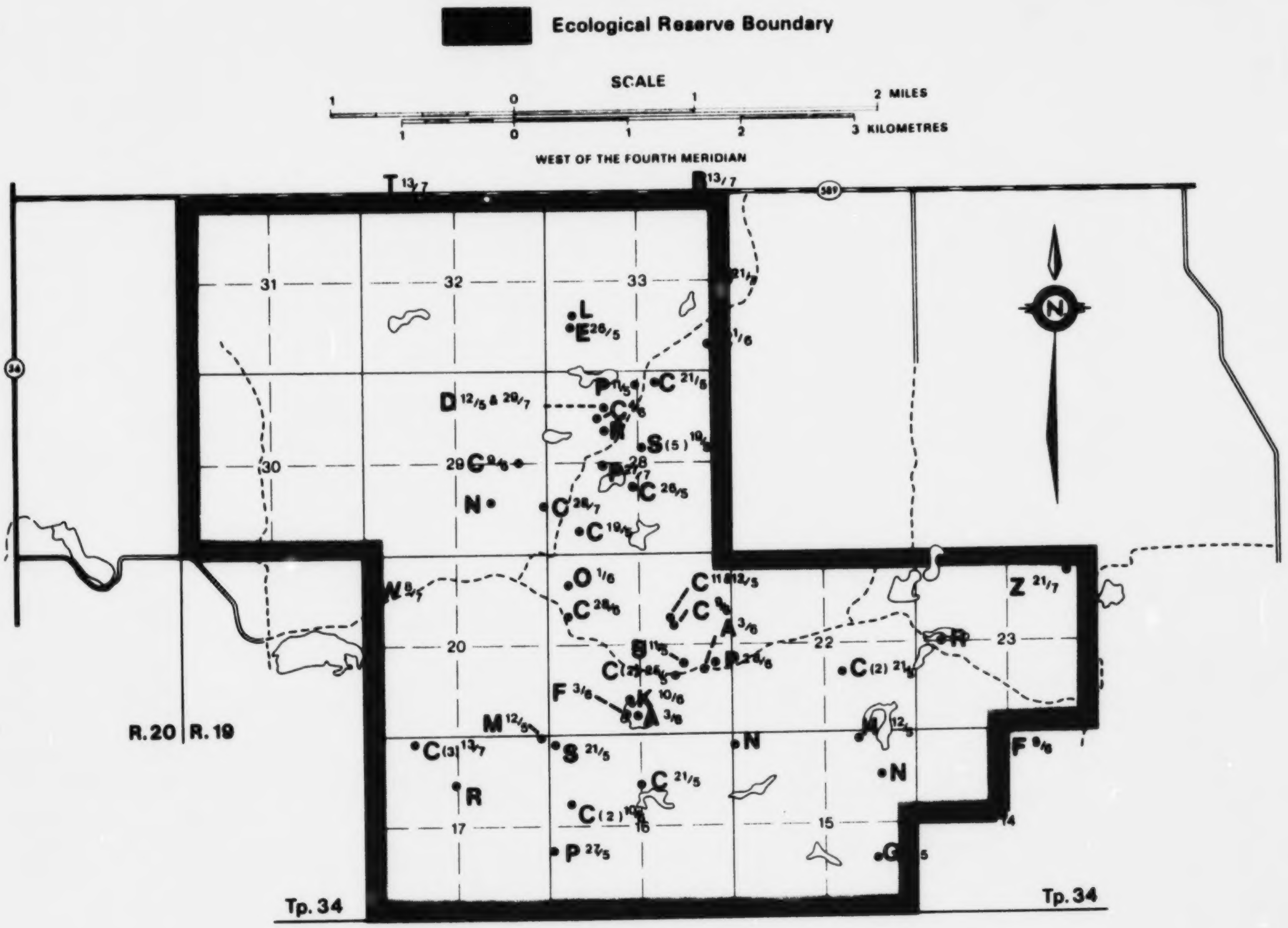
The only mammal survey reported for the area was done by Salt (1975). He used field observations and museum specimens to compile a list of 22 species. Only nine species were observed in 1982; however, no attempt was made to survey the microtine rodents and other small mammals. A survey of the mammals in the candidate reserve could be rewarding due to the paucity of information about mammals in the region. Appendix 12 is an annotated list of the mammals.

Historically, the region supported bison, wapiti, grizzly bears, wolves and prairie dogs, but according to Farley (1925), they had all disappeared by the late 1800's. He also reported that moose were hunted near Dried Meat Lake, 100 km north of the candidate reserve, and pronghorn were seen 80 km northeast of the reserve.

FIGURE 4

RUMSEY ECOLOGICAL RESERVE

SELECTED WILDLIFE SITINGS



Ecological Reserve Boundary
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WEST OF THE FOURTH MERIDIAN
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C 26/6
W 8/7
B 1/5
P 26/6
C (2) 26/5
F 3/6
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A 3/6
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P 27/5
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Figure 4 SELECTED WILDLIFE SITINGS

LEGEND

D	Canada goose
E	horned grebe
F	great blue heron
A	avocet
O	short-eared owl
M	marsh hawk
K	Cooper's hawk
H	sharp shinned hawk
G	ruffed grouse
S	sharp tailed grouse
W	hairy woodpecker
Z	plains garter snake
T	white-tailed jack rabbit
P	porcupine
B	beaver
C	coyote
N	active red-tailed hawk nest
L	old beaver lodge
R	Richardson's ground squirrel colony
( )	number of animals sighted (if greater than 1)
21/5	day/month

Figure 5 DEER SIGHTINGS (May - August, 1982)

Number of deer per observation indicated in brackets when greater than 1.

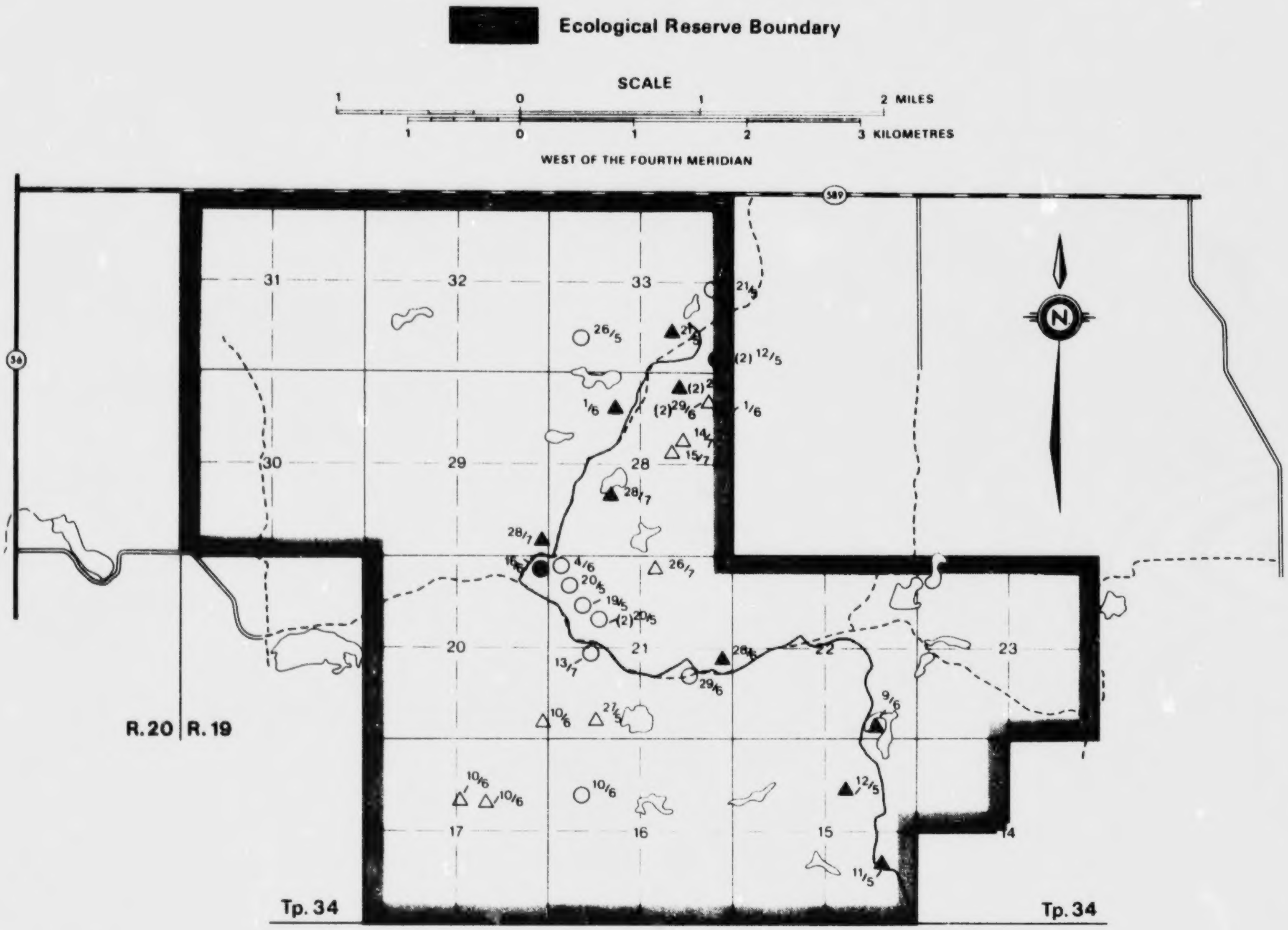
LEGEND

——	Survey Route
●	Mule Deer seen on survey route.
○	Mule Deer not seen on survey route.
▲	White-tailed Deer seen on survey route.
△	White-tailed Deer not seen on survey route.
21/9	Day/Month

FIGURE 5

RUMSEY ECOLOGICAL RESERVE

DEER SIGHTINGS (MAY-AUGUST, 1982)



Ecological Reserve Boundary
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According to local farmers and ranchers, pronghorn antelope are occasionally seen in the spring until the end of June. They have been seen throughout the reserve since the 1940's (Webster 1982, pers. comm.). Moose have been seen on three or four occasions within the last 3 years. One moose was seen by a ranchhand in July, 1982 (Chick and Jacobson 1982, pers. comm.). They are not permanent residents of the area.

A total of 13 deer were observed during the survey (Appendix 6). Ten (77%) of them were white-tailed deer and three (23%) were mule deer. If all deer sightings are used, 59% (19 of 32) of them are white-tailed deer.

There were differences in the two species' distribution. The distribution of deer sightings corresponds roughly to the area where most of the field work was done (Figure 5). White-tailed deer were observed throughout this area while mule deer were concentrated in sections 21 and 33. The total number of mule deer observed may be artificially high as the field camp was located in the northwest quarter of section 21 where 6 of 13 sightings were recorded. Almost all the deer were observed while they were browsing shrubs or aspen grove edges.

Four rodents were identified. Thirteen-lined ground squirrels were found throughout the reserve while Richardson's ground squirrels were found in three discrete colonies in heavily grazed or disturbed areas. One beaver was seen and an old was lodge located. No muskrats were seen in 1982 but they do occur in the area (Salt 1975; Webster 1982, pers. comm.) Four porcupines were also seen.

Twenty-two sightings of coyotes were made. Although no dens found were deemed active, a ranchhand found a den this year with pups (Jacobson 1982, pers. comm.). The population seems to be stable (Webster 1982, pers. comm.). No foxes have been seen in the area.

3. Reptiles and Amphibians

Boreal chorus frogs (*Pseudacris triseriata*) and wood frogs (*Rana sylvatica*) were often seen around sloughs. Wroe (1971) considered the Northern leopard frog (*Rana pipiens*) to be abundant around sloughs in NW 14-34-19-W4 but none were observed in 1982.

A dead tiger salamander (*Ambystoma tigrinum*) was found on the vehicle trail in section 21.

One plains garter snake (*Thamnophis radix*) was found in section 23. A red-sided garter snake (*Thamnophis sirtalis*) was reported in NW 14-34-19-W4 (Wroe 1971).

Disturbed Sites

Most disturbances are associated with the ranching operations and the oil and gas industry. Figure 3 shows the locations of the disturbed sites.

Figure 3 DISTURBED SITES

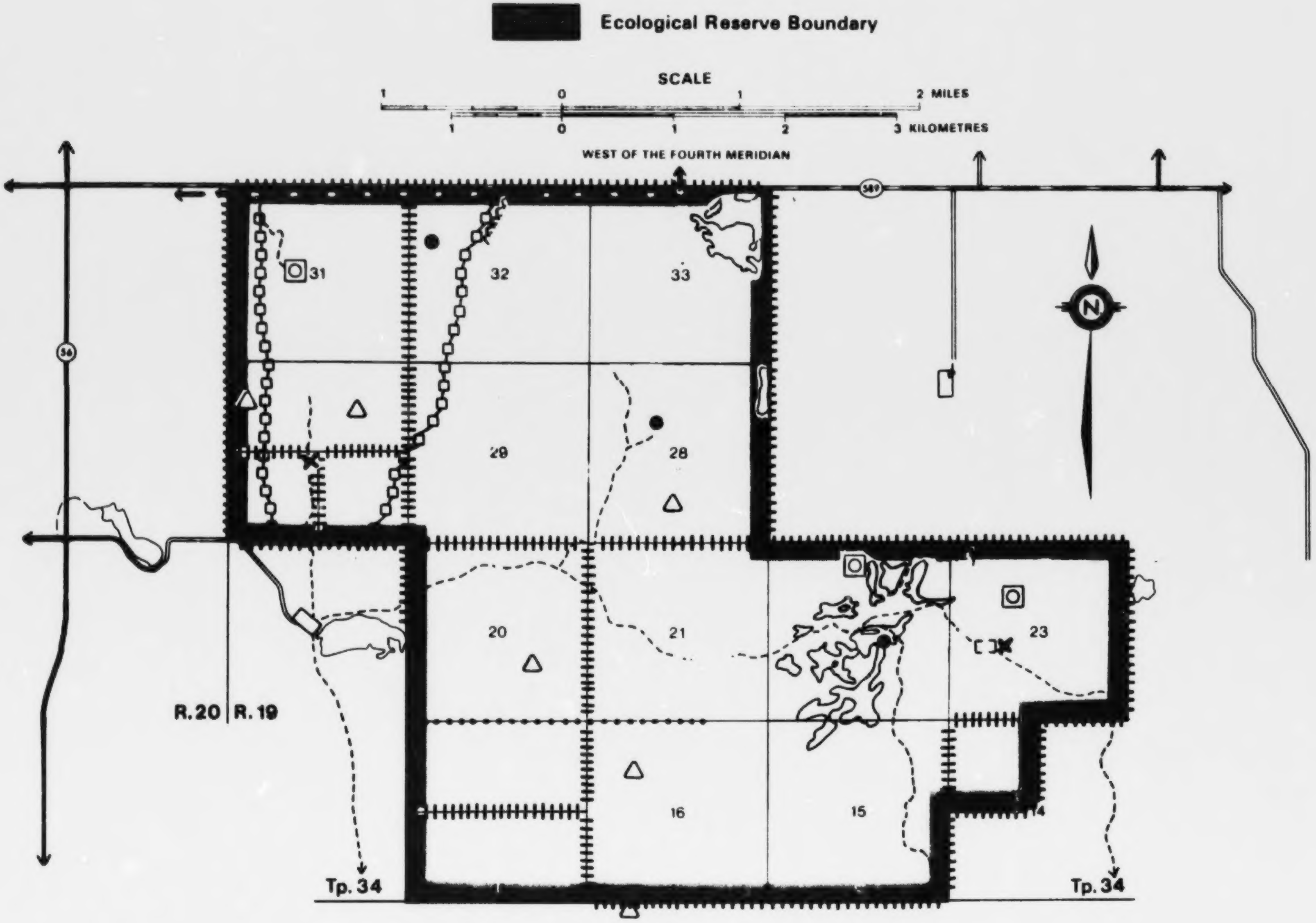
LEGEND

—⑫—	Primary Highway
━⑥━	Secondary Highway
═══	Improved Roads
- - - - - - -	Improved Trails
———	Section Lines
23	Section Numbers
┼┼┼┼┼┼┼┼┼┼	Fence Lines
•-•-•-•-•	Seismic Lines
— — —	Buried Cable
-□-□-□-□-	Edge of Burn, 1981
^^^^^^^^	Section of Fire Break Line
▭	Farm
△	Ducks Unlimited (Canada) Drainage Ditches
⊡	Well Sites
[ ]	Abandoned Barn
☁	Hayed Areas
●	Hay Feed Enclosure
×	Watering Well

FIGURE 3

RUMSEY ECOLOGICAL RESERVE

DISTURBED SITES


Ecological Reserve Boundary
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WEST OF THE FOURTH MERIDIAN
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Bison and most other large ungulates disappeared from the area by about 1890 (Farley 1925) and, since domestic livestock were not brought into the area until around the turn of the century, the range was lightly used and probably in good condition (Wroe 1971).

The Usher lease has had a history of good management. In 1976, the range was rated to be in good to excellent condition by Alberta Lands. Extensive fescue grassland throughout the reserve is a reflection of such management.

The candidate reserve is part of a rotational grazing system. Cows are wintered in the northeast field (Sections 28, 29, 32 & 33) beginning in October and ending in the early spring when they are moved to a field (which includes Sections 17 and 21) east of the ranch buildings. After calving in spring they are moved from the reserve. Yearlings are wintered from October to June in the southeast field (Sections 15, 16, 21, 22 and 23). The northwest fields (Sections 30 and 31) are used as horse and bull pastures. The horses remain there all year round, but in June the bulls are moved out for the summer (Webster 1982, pers. comm.). With this grazing system little grazing takes place during the growing season. As dormant season grazing is less harmful to plants than grazing during the growing season (Johnston et al 1981), this grazing system has probably helped maintain a healthy range.

The range is in good to excellent condition overall. The cattle prefer to graze the grass stands on the south slopes and crests so many of the stands with a southerly aspect are fairly heavily grazed while the remaining stands, primarily fescue grasslands, are only lightly grazed.

The carrying capacity was set by Alberta Lands and Forests in 1962 at 28 acres/head/year. Wroe (1968) estimated it to be 30 acres/head/year in 1968. The actual stocking rate has usually been over 30 acres/head/year but has ranged from 26 to 34 acres/head/year (Bradley and Bradley 1977).

Several grassland and wet meadow stands are mowed for livestock feed. The low shrubs, such as Symphoricarpos occidentalis, are avoided when mowing. A stand is mowed once every four or five years depending upon the moisture conditions (Webster 1982, pers. comm.). The areas mowed in 1980 and 1981 are indicated on Figure 3.

Associated with haying are three enclosures used for storing hay. The enclosure in section 32 was not fenced in 1982.

In 1911 the candidate reserve was fenced for the first time. The perimeter of the reserve is fenced, except the outer edges of sections 17 and 20. Fences divide the candidate reserve into 8 separate fields.

Three water wells for livestock are present. Compared to most of the candidate reserve, heavy grazing occurs around the wells.

Four vehicle trails, five to seven metres in width, have been constructed with a grader at different times during the past 14 years to permit easier access to the cattle and to haying sites. The trails follow the lay of the land but on hillsides cuts are made into the hills to level the trail. In the past, the trails have been graded every few years. All trails are partially vegetated with both native and introduced plant species.

The most conspicuous distubances associated with the oil and gas industry are seismic cutlines. In February 1982 a seismic line was cut into the southwest quarter of the reserve. It is 6 to 9 m wide and extends for 2.4 km into the reserve from the west border. On the grasslands tire ruts and lugged track cuts were made in the soil. They were not revegetated during the 1982 growing season. In aspen poplar groves the vegetation was removed down to the soil. By late July, S. occidentalis and aspen poplar suckers had revegetated the cutlines. A saline slough that had been crossed was revegetated by August 1982.

Many seismic lines have been cut in the reserve in the past (Usher and Webster 1982, pers. comm.); however, except for a few old revegetated cutlines through aspen groves, no evidence of them was found.

Three gas wells are situated in the reserve. Around each, 0.10 to 0.25 ha of land was cleared and later reseeded to crested wheat grass (Agropyron cristatum) and brome grass (Bromus inermis). Native and introduced plant species are gradually invading the area. A trail for service vehicles runs to the well in section 31 from Highway 589. Trails to the other two wells have grown back almost completely.

Tire tracks in the grass are common throughout the reserve due to ranchers, hunters, biologists and seismic crews driving vehicles off the main trails. The grass is thick and once trampled it takes a long time to recover. Tracks from the previous year were still evident in June 1982.

In the spring of 1980 a fire swept north from the ranch buildings in Section 19, through sections 21, 30, 31 and 32 to Highway 589 (Webster 1982, pers. comm.). Prior to the 1980 fire the last fire was in 1964 (Wroe 1971).

Firebreaks are distributed in a broken line along the east edge of the fire. They are about 1 m wide and vary greatly in length. Most of them are revegetated but, since the humus is sparse, the soil is exposed.

Special Features

See Appendix 13.

1. Moraine plateaux: The plateaux in the candidate reserve are excellent examples of this landform, wich is typical of a hummocky disintegration moraine.
2. Glacial Spillway and Esker Complex: Both these features are due to glacial action. They are the only sites in the reserve that are not knob and kettle moraine.
3. White-tailed Jackrabbit: This species is uncommon in the area due to the scarcity of level land.
4. Beaver: The candidate reserve is near the south edge of their range east and central Alberta. Their numbers probably fluctuate with the water conditions.
5. Richardson's Ground Squirrel: This mammal is quite common throughout the grasslands; however, in the candidate reserve only three widely separated colonies were found.
6. Red-tailed Hawk Nest: Like many raptorial birds this species has suffered from persecution in the past and now is confronted with the loss of their hunting and nesting habitat. Three active nests were found and there are probably more in the reserve.
7. *Allium geyerii*: This species is rare in Alberta (Packer and Bradley 1978).
8. Ungrazed quarter secton (NW 14-34-19-W4): Formerly known as the 'Big Valley Natural Area' it has not been grazed since 1970. Lush, dense fescue grasslands are found throughout the quarter. Two uncommon bird species are found there:Sprague's Pipet and Baird's Sparrow.

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APPENDICES

Appendix 1

Soil profiles and classification.

Pit No.	Community Type	Classification	Depth(cm)	Horizon	Moist Colour	Texture
1.	*Stipa-Artemisia*	Eluviated Dark Brown Chernozem	0-5	LH	10 YR 3/1	Loam
			5-36	Ah	10 YR 3/2	Clay loam
			36-54	Ahe	10 YR 3/3	Clay loam
			54-96	Bm	10 YR 3/3	Clay loam
			96	Ccasa	10 YR 3/3	Clay loam
2.	*Stipa-Festuca*(I1)	Orthic Dark Brown Chernozem	04	LH		
			4-17	Ah	10 YR 3/2	Loam
			17-32	Bm	10 YR 5/3	Clay loam
			32	Ccasa	10 YR 5/3	Clay loam
3.	*Festuca Scabrella* (HT)	Orthic Dark Brown Chernozem	0-3	LH		
			3-14	Ah	10 YR 3/1	Loam
			14-27	Bm	10 YR 3/2	Clay loam
			27-32	Bmk	10 YR 5/3	Clay loam
			32	Cca	10 YR 5/3	Clay loam
4.	*Festuca scabrella*	Regosolic Dark Brown Chernozem	0-2	LH		
			2-18	Ah	10 YR 3/2	Loam
			18	Cca	10 YR 3/3	Loam
5.	*Symphoricarpos occidentalis*	Orthic Dark Brown Chernozem	0-13	LH		
			13-19	Drift		Fine sand
			19-51	Ah	10 YR 2/1	Sandy loam
			51-67	Bm	10 YR 3/3	Clay loam
			67	Cca	10 YR 5/3	Clay loam
6.	*Symphoricarpos occidentali*(F2)	Orthic Dark Brown Chernozem	0-3	LH		
			3-19	Ah	10 YR 3/2	Sandy loam
			14-49	Bm	10 YR 3/3	Sandy loam
			49	Cca	10 YR 5/3	Loam
7.	*Populus tremuloides*	Orthic Dark Brown Chernozem	0-3	LH		
			3-16	Ah	10 YR 2/1	Loam
			16-44	Bm	10 YR 3/2	Clay loam
			44	Ccasa	10 YR 3/3	Clay loam
8.	*Populus tremuloides*(E2)	Eluviated Dark Brown Chernozem	0-5	LH		
			5-23	Ah	10 YR 2/1	Loam
			23-50	Aej	10 YR 3/2	Loam
			50-79	Btg	2.5 YR 2/0	Clay
			79-112	BC	10 YR 3/1	Sandy Clay
			112	Cca		

Appendix 1.
Continued

Pit No.	Community Type	Classification	Depth(cm)	Horizon	Moist Colour	Texture
9.	*Salix petiolaris* (D1)	Orthic Humic Gleysol	0-4	LH		
			4-26	Ah	10 YR 2/1	Clay loam
			26-34	AB	10 YR 3/1	Clay loam
			34-67	Bg	10 YR 5/1	Clay loam
			67	Ccag	10 YR 5/1	Clay loam
10.	*Salix petiolaris*		0-2	LH		
		Orthic Humic Gleysol	2-18	Ah	10 YR 3/1	Loam
			18-157	Bg	10 YR 3/2	Clay loam
			157	Cca	10 YR 4/2.5	Clay loam
11.	*Carex-Scolochloa* *Poa-Cirsium*	Rego Humic Gleysol	0-3	F		
			3-27	Ah	10 YR 3/1	Clay
			27-89	Cg	2.5 YR 2/0	Clay

Appendix 2 STUDY SITES OF COMMUNITY TYPES DESCRIBED

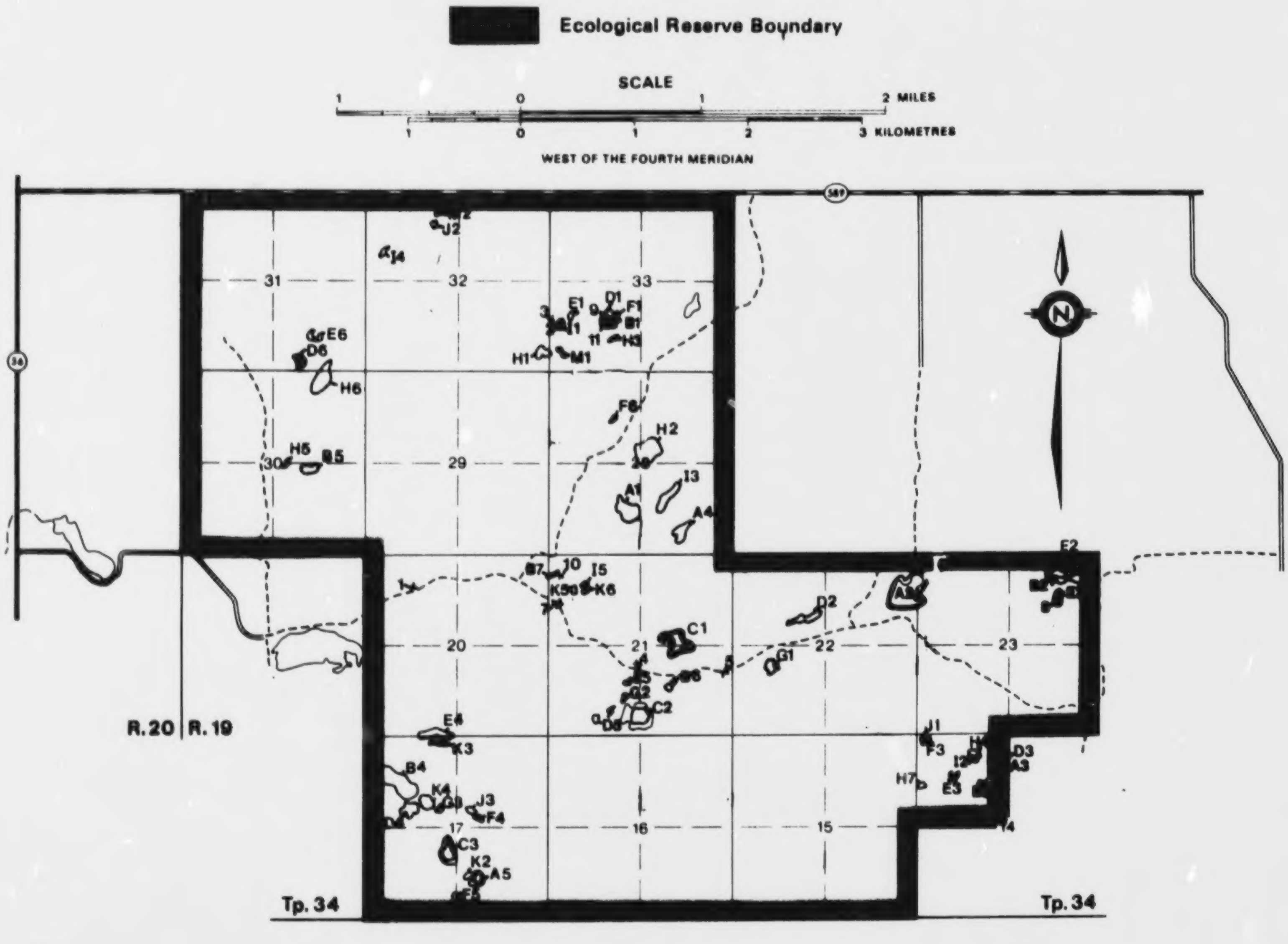
LEGEND

Community Type Designation (Stand Number)	Community Type Name
A (1-5)	Carex atherodes - Scolochloa festucacea - Eleocharis palustris - Typha latifolia
B (1-7)	Carex atherodes - Scolochloa festucacea - Poa palustris - Cirsium arvense
C (1-3)	Scirpus paludosus - Puccinellia nuttalliana - Hordeum jubatum - Distichlis stricta
D (1-6)	Salix petiolaris
E (1-6)	Populus tremuloides
F (1-6)	Symphoricarpos occidentalis
G (1-3)	Elaeagnus commutata
H (1-7)	Festuca scabrella
I (1-5)	Stipa spartea var. curtiseta - Festuca scabrella
J (1-3)	Stipa spartea var. curtiseta - Artemisia frigida
K (1-6)	Bouteloua gracilis - Artemisia frigida
L (0)	No stands inspected. Information from Wroe (1971)
M (1-2)	Agrostis scabra - Achillea millefolium - Antennaria nitida
X	Soil pits

APPENDIX 2

RUMSEY ECOLOGICAL RESERVE

COMMUNITY TYPES DESCRIBED


Ecological Reserve Boundary
SCALE
1
0
1
2 MILES
1
0
1
2
3 KILOMETRES
WEST OF THE FOURTH MERIDIAN
N
56
36
31
32
33
29
20
21
22
23
17
16
15
30
R.20
R.19
Tp. 34
Tp. 34
J2
J4
E6
D6
H6
H5
B5
E1
D1
F1
B1
H3
H1
M1
F6
H2
I3
A1
A4
B7
I5
K5
K6
C1
D2
G1
G2
C2
D5
E2
J1
F3
I2
D3
A3
H7
E3
I4
E4
K3
B4
K4
J3
F4
C3
K2
A5

Appendix 3 LAND DISPOSITIONS AND EASEMENTS

(from Alberta Township Registry 1982)

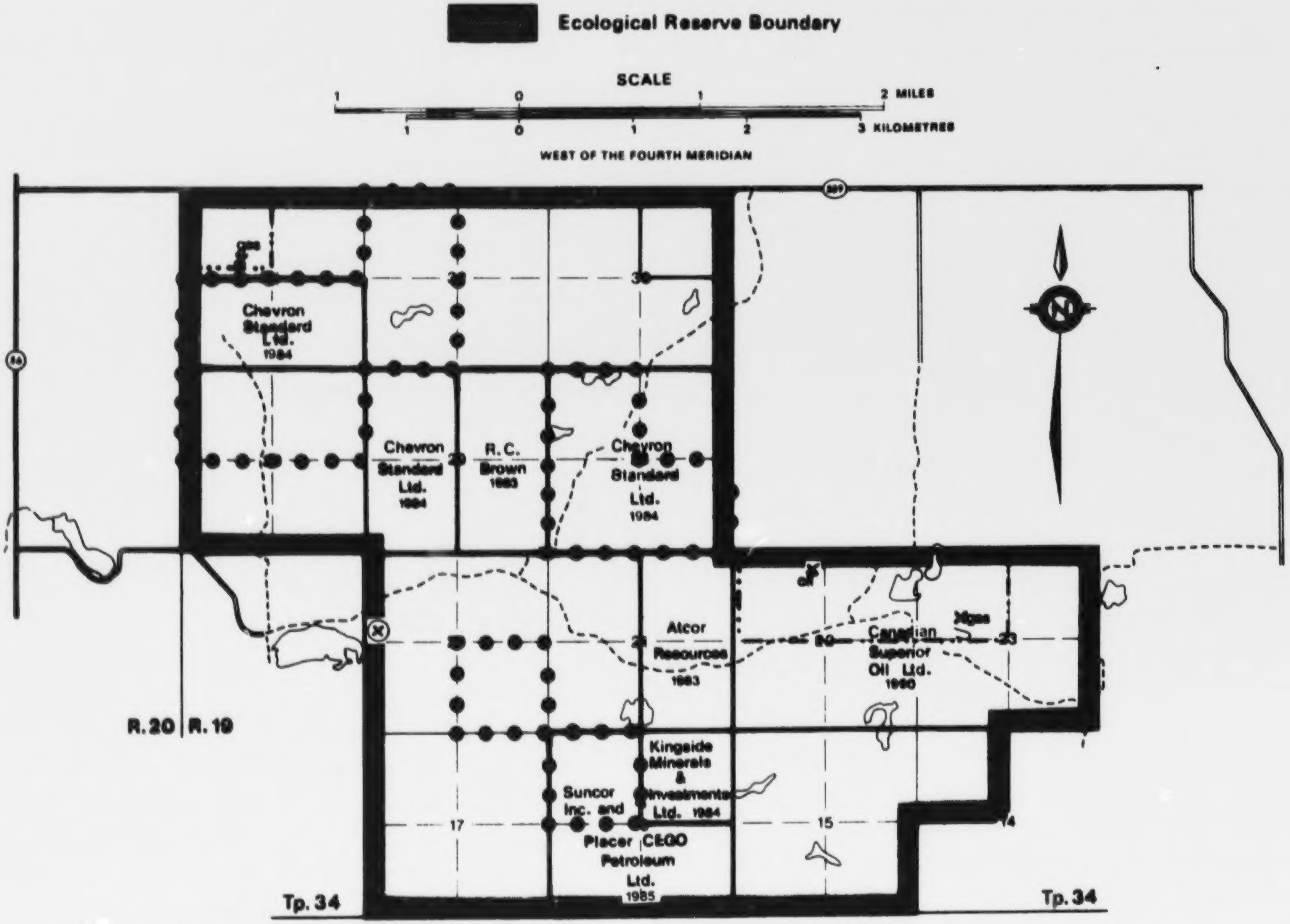
LEGEND

	Entire candidate reserve under grazing lease GRL 33419.
▭	Petroleum and natural gas leases. Lessee and expiry date indicated.
	Entire township under Crown Coal Reserve, since 1975.
⬚	Mohawk Oil route access.
▭	Alberta Power easement.
– – – –	Alberta Government Telephones Licence of Occupation.
● ● ● ● ●	Ducks Unlimited Canada easement (EZ 1481 and EZ 1855).
x	Wells drilled by Mohawk Oil et al. Byemoor.
⊗	Abandoned well site of Tartan Lancer Big Valley.

APPENDIX 3

RUMSEY ECOLOGICAL RESERVE

LAND DISPOSITIONS AND EASEMENTS


Ecological Reserve Boundary
SCALE
1
0
1
2 MILES
1
0
1
2
3 KILOMETRES
WEST OF THE FOURTH MERIDIAN
Chevron Standard Ltd. 1984
Chevron Standard Ltd. 1984
R.C. Brown 1983
Chevron Standard Ltd. 1984
Atcor Resources 1983
Canadian Superior Oil Ltd. 1980
Kingside Minerals & Investments Ltd. 1984
Suncor Inc. and Placer CEGO Petroleum Ltd. 1985
30
29
20
21
22
23
17
15
14
R.20
R.19
Tp. 34
Tp. 34
N

APPENDIX 4

STAND DESCRIPTION

Veg. Plot No. 1.

Project I.D 8.

Legal 14.

Location ______________________

Biog. Z. 21.

IBP Code 23.

Veg. Type 28.

Landform 32.

Elevation 36.

Slope 40.

Aspect 42.

Soil 44.

Sociation Name ______________________

Site Position Diagram (refer to data form no. ____________)

Photo roll no. ________

Photo no. ________

Scale

Direction ←→

General Description and Remarks:

	47. Moisture Regime	48. Drainage	49. Site Position	50. Stability Index	51. Microtop
1	very xeric	rapidly	crest	unstable	smooth
2	xeric	well	upper slope	rapid change	micro-mound
3	subxeric	mod. well	middle slope	mod. change	slightly mound
4.	submesic	imperfectly	lower slope	slow change	mod. mound
5.	mesic	poorly	toe	stable	strongly mound
6	subhygric	very poorly	depression	climax	severely mound
7.	hygric		level		extr. mound
8	subhydric				ultra mound
9	hydric				

Rock 52.

Humus 54.

Min. Soil 56.

Deadfall 58.

Water 60.

T. Unveg. 62.

% Cover	Species	Cover	Av. Hgt.	DBH	Rings
Tree C. I 64.					
Tree C. II 66.					
Shrub C. I 68.					
Shrub C. II 70.					

72. Herb Dwarf Shrub

74. Bryoid

Plot No 1.

Date

Other Obs

LYR	CODE	%	SPECIES	LYR	CODE	%	SPECIES
8.	10.	14.					

Appendix 5 LOCATION OF SLOUGHS INSPECTED DURING THE WATERFOWL SURVEY AND THE LOCATION OF THE DEER SURVEY ROUTE

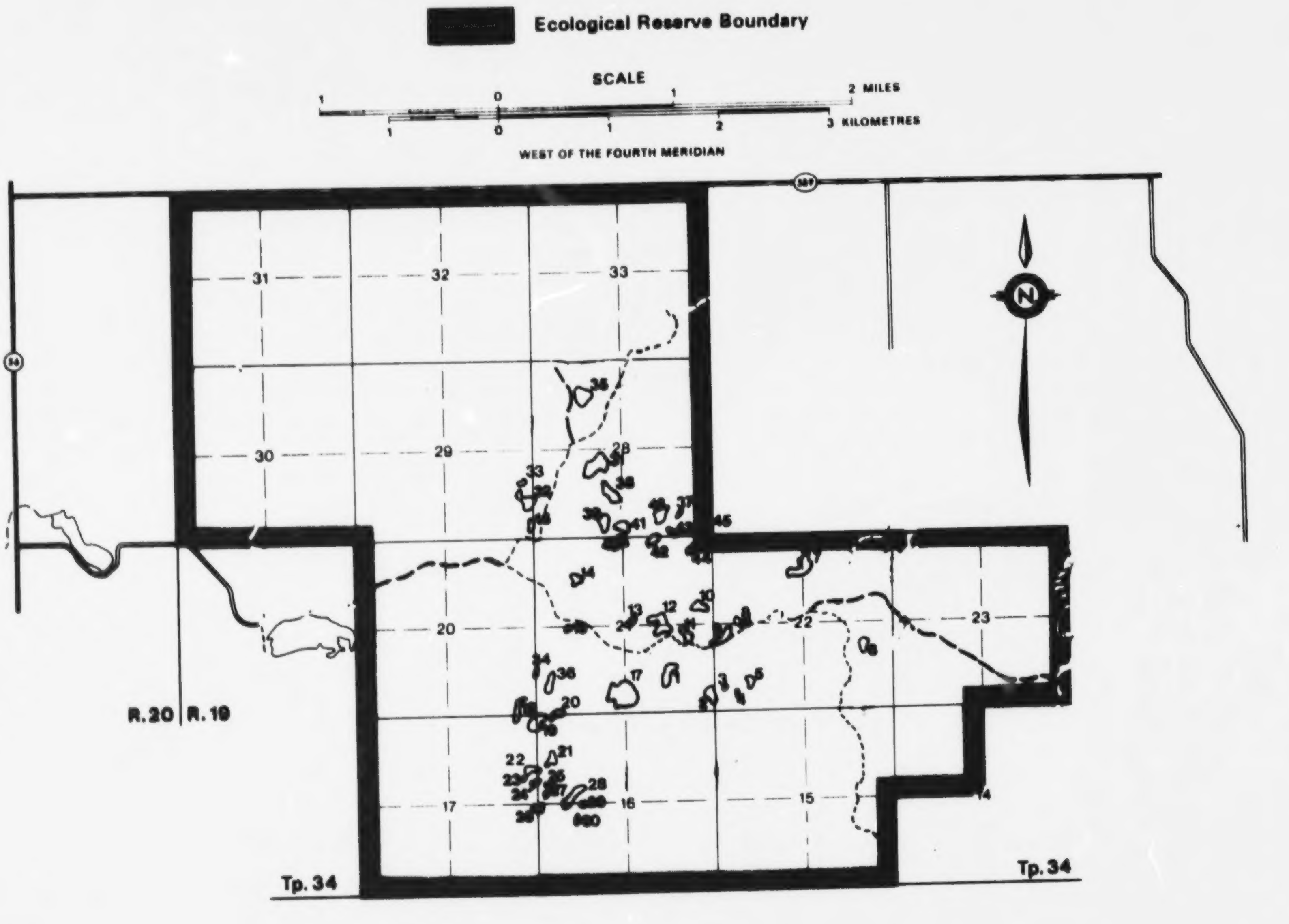
LEGEND

⬭ 1	Sloughs Inspected
----	Deer Survey Route
▬▬▬	Improved Trails

APPENDIX 5

RUMSEY ECOLOGICAL RESERVE

INSPECTED SLOUGH LOCATIONS AND DEER SURVEY ROUTES


Ecological Reserve Boundary
SCALE
1
0
1
2 MILES
1
0
1
2
3 KILOMETRES
WEST OF THE FOURTH MERIDIAN
N
31
32
33
30
29
28
20
22
23
17
16
15
14
R.20 | R.19
Tp. 34
Tp. 34
1
3
5
6
10
12
13
14
17
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42
45

Appenidix 6

Deer and selected animal sightings during road survey, plus general deer observations.

		Road Survey			General Observation	
Date	Time	W-t Deer	Mule Deer	Other Animals	W-t Deer	Mule Deer
May 11	PM	1 (SE15)[b]	0	Porcupine (NW28) Coyote (NE21)	0	0
May 12	AM	1 (NE15)	2 (SE33)	Coyote (NE21)	0	0
May 19[c]	-	-	-	-	-	1 (NW21)
May 20	PM	0	0	0	0	1 (NW21) 2 (NW21)
May 21	AM	2 (NE28) 1 (SE33)	0	Coyote (NE28)	0	1 (SE33)
May 26	PM	0	0	0	0	1
May 27[c]	-	-	-	-	1 (SW21)	0
June 1	PM	1 (NW28) 1 (NE28)	0	0	0	0
June 3	AM	0	0	0	0	0
June 4[c]	-	-	-	-	0	1 (NW21)
June 9	PM	0	0	Coyote (SE29)	0	0
June 10	AM	0	0	0	1 NE17 1 NE17 1 SE20	1 (NW16)
June 16	AM	0	1 (NE20)	0	0	0
June 28	PM	1 (SW21)		Porcupine (SE21)		
June 29	AM	0	0	0	2 (NE 28)	1 (SE21)
July 7	PM	0	0	0	0	0
July 13[c]	-	-	-	-	-	1 (NW21)
July 14	PM	0	0	0	1 (NE 28)	0
July 15	AM	0	0	0	1 (NE 28)	0
July 19	PM	0	0	0	0	0
July 21	AM	0	0	0	0	0
July 26[c]	-	-	-	-	1 (NE21)	0
July 27	PM	0	0	Porcupine (SW28)	0	0
July 28	AM	1 (SW28) 1 (SE29)	0	Coyote (SE29)	0	0
August 24	AM	0	0	0	0	0
TOTAL		10	3	-	9	10

a. AM: within 3 hours of first light; PM: within 3 hours of last light
b. Number and location of animals
c. Deer survey not done on this day.
d. White-taled Deer.

Appendix 7

Canadian Wildlife Service method for determining the total number of indicated ducks (Turner 1982, pers. comm.)

Lone drakes:	the total number of lone males observed.
Lone Hens:	the total number of lone hens observed (redheads, scaups, ring-necked ducks and ruddy ducks only).
Flocked drakes:	the total number of males observed with one or more other males (no females present). Flocked drakes of 11 species numbering 5 or more per grouping were treated as a "group" (multiplied by one in calculating "total indicated birds").
Pairs:	the total number of male and female groupings observed.
Groups:	the total number of individuals, both male and female, which cannot be separated into singles and pairs at the time of observation.
Total indicated birds:	the total number of birds observed on the sloughs with allowances for hens not observed with single and flocked drakes. Total indicated birds is calculated by multiplying lone drakes by two, lone hens by one, flocked drakes by two, the number of pairs by two and grouped birds by one. In the case of redheads, scaup, ring-necked ducks, and ruddy ducks, lone and flocked drakes and lone hens are multiplied by one in determining total indicated birds.

Appendix 8

Annotated list of the vascular flora of the candidate Rumsey Ecological Reserve.

Equisetaceae

Equisetum arvense - Fairly common species in moist and shaded woodlands. Stands: D1,2,4.

Equisetum laeigatum - Uncommon, moist meadows. Stands B4.

Equisetum sylvaticum - Uncommon woodland species.

Selaginellaceae

Selaginella densa - Forms dense mats in dry grassland areas. Stands: J3;K1,4,M2.

Pinaceae

Juniperus horizontalis - Uncommon shrub of moist prairie. Only conifer found in reserve.

Typhaceae

Typha latifolia - A co-dominant of communities occupying slough edges. Stands: A1-5.

Najadaceae

Potamogeton filiformis - slough.

Potamogeton pectinatus - Fairly common aquatic species. Stand: A5.

Potamogeton pusillus - Common, aquatic. Stand: A5.

Zannichellia palustris - Fairly common in sloughs in reserve.

Juncaginaceae

Triglochin maritima - A species of saline slough shores. Stands: B4; C1,2.

Alismaceae

Alisma gramineum - Aquatic, found in two sloughs in reserve. Stand: A5.

Gramineae

Agropyron cristatum - Found in disturbed sites around oil and gas wells.

Agropyron dasystachyum - Grassland species. Stand: H1.

Agropyron repens - Widespread in reserve: Stands: E3,6,; G1.

Agropyron riparium - Prairie species. Stand: I3.

Agropyron smithii - Fairly common in prairie. Stands: B4; C3.

*Agropyron spicatum - Found in dry grasslands.

Agropyron subsecundum - Fairly common, found in grasslands, shrubland and aspen groves. Stands: B2,4; C2; E1,4; F1-5; G1, H1,2,6,7; I1 J3, C2.

Agropyron trachycaulum - Woodlands and meadows. Stands: B2, 4; G2.

Agrostis alba - Wet meadow species, uncommon. Stand: B6.

Agrostis scabra - Widespread, in moist areas. Stands: A5; B1, 4, 7; D6; E1; G1, 2; H11, 2, 4, 7; K4; M1, 2.

Alopecurus aequalis - Common in sloughs. Stands: A1, 2, 3, 5; B7.

Avena sativa - Disturbed site.

Beckmania syzigachne - Common, sloughs and wet meadows. Stands: A1, 2, 3, 5; B1, 2, 6, 7; C2; D3.

Bouteloua gracilis - Found frequently in dry grasslands, especially on south-facing slopes. Stands: I1, 3, 4, 5; J1, 2, 3; K1-6; M2.

Bromus anomalus - Recorded in woodlands and shrublands, not common. Stands: D4, 6; E4, 6;F2, 6.

Bromus ciliatus - Fairly common in woodlands. Stands: D2, E3, 5.

Bromus inermis - Widespread in reserve. Stands: E6, 3; G1,2.

Bromus pumpelliamus - Found in aspen groves and S. occidentalis. Stands: E3; F1, 6.

Calmagrostis inexpansa - Common, moist meadows and woodlands, sloughs. Stands: A3, 4, 5; B4, 5, 6, 7; D3; E2, 6.

*Calmagrostis montanensis - A rare grassland species.

Calmovilfa longifolia - Found on a dry south-facing slope.

Danthonia intermedia - Found throughout grasslands. Stands: H1, 3, 4, 6, 7; I1, 3, 4, 5; J1, 2; K11, 3, 4, 5, 6.

*Danthonia parryi - Grassland species rare.

Deschampsia caespitosa - Minor constituent of Koeleria - agropyron communities.

Distichlis stricta - Co-dominant of saline slough shores. Stands: C1-3.

Elymus innovatus - Found in prairie. Stand: I4.

*Festuca idahoensis - A rare grassland species.

Festuca scabrella - The dominant grass species in the reserve. It is a dominant of one community (Festuca scabrella), a co-dominant of another (Stipa - Festuca) and a common constituent of three others (Symphoricarpos, Stipa - Artemisia) and (Boutelara - Aretenisia). Stands: F2, 3, 6; H1-7; I1-5; J1, 2; K4, 6.

Glyceria grandis - Common grass in sloughs. Stands: S1, 2, 3, 5; B7.

Glyceria striata - One specimen found in a wet meadow. Stand: B6.

Helictotrichon hookeri - Found throughout grasslands and in Symphoricarpos occidentalis stands.

Heirochloe odorata - A rare grassland species. Stand: I2..

Hordeum jubatum - This grass is widespread in moist areas in the reserve. It is a co-dominant in the community found on saline slough shores. Stands: A1-5; B1-7.

Koeleria cristata - Common in dry grasslands, slopes particularly. Co-dominant of Koeleria - Agropyron community types. Stands: A1; H1; I1-5; J1, 2, 3; K1-6; M2.

Muhlenbergia cuspidata - Dry prairie species, fairly common. Stands: K1, 6.

*Muhlenbergia squarrosa - Inhabits grassland and damp thickets, rare.

Poa ampla - Recorded once in an aspen poplar grove.

Poa interior - Widespread in reserve. Stands: B7; E4; F2, 3; H1, 3, 7; M1; D2

Poa juncifolia - Found in moist thickets. Stand: E3.

Poa palustris - Dominant in wet meadow community type and found commonly in moist woodlands and grasslands. Common, moist woodlands and meadows. Stands: A1, 2, 3, 5; B1-7; C2; D1, 3, 4, 5, 6; F6; G1, 2; M1; E6 3

Poa pratensis - Fairly common in moist areas. Stands: B6; D2; E6.

Poa secunda - Common dry prairie species. Stands: C1; I3, 4; J2; K1, 6; M1.

Puccinellia nuttalliana - Co-dominant on saline slough shores. Stands: C1-3.

Scolochloa festucacea - Co-dominant in sloughs and wet meadows. Stands: A1-5; B1-7.

Setaria viridis - This plant of disturbed areas is rare.

Sphenopholis intermedia - Rare, found in a wet meadow. Stand: B4.

*Stipa comata - A dry grassland species that is rare in the reserve.

Stipa spartea var. curtiseta - A leading grass in the reserve especially on dry south-facing slopes Stands: F4, 6; H1, 3, 4; I1-5; J1-3; K1-6; M2.

Stipa viridula - Fairly common in S. occidentalis stands and grasslands. Stands: F1-6; G1.

Cyperaceae

Carex arthrostachya - Rare, marshy areas. Stand: D2.

Carex atherodes - The dominant sedge in sloughs and wet meadows. Stands: A1-5; B1-7.

Carex aurea - One specimen found on the shores of a saline slough. Stand: C2.

Carex bebbii - Found in moist meadows and woodlands. Stands: B1; G2.

Carex eleocharis - This sedge is found fairly commonly in dry grasslands.

Carex filifolia - Found in prairie occupying south slopes. Stands: H3; J1.

Carex foenea - dry grassy area.

*Carex heliophilia - A sedge of dry areas, uncommon.

*Carex lasiocarpa - Found in moist thickets and fescue grasslands.

Carex obtusata - Sedge of prairie.

Carex praegracilis - Moist woodlands and meadows. Stand: B4.

Carex praticola - Found in woodlands and moist meadows. Stands: E4, 5; F4, 5; G1, 2.

#*Carex rostrata - Fairly common, sloughs and willow stands.

Carex sartwellii - Slough edge. Stand: A3

*Carex scirpoidea - Found in Stipa - Festuca stands.

Carex scirpiformis - moist grassy meadow. Stand: C4

Eleocharis palustris - Common in wet locations. It is a dominant in fresh water sloughs. Stands: A1-5; B5, 7; C1-3.

Scirpus acutus - Recorded in fresh water sloughs. Stands: A1 and 5.

Scirpus americanus - A salt tolerant species found around saline sloughs. Stands: C2 and 3.

Scirpus paludosus - A dominant in saline sloughs and found commonly in other wet areas. Stands: A1, 2; B5; C1-3.

Scirpus validus - A species of fresh water sloughs. Stands: S1, 3, 4.

Lemnaceae

Lemna minar - Common in sloughs. Stands: A3, 4, 5.

Lemna trisulca - Common in sloughs. Stands: A1, 3, 4, 5.

Juncaceae

Juncus balticus var. montanus - Found around sloughs in wet meadows and occasionally moist woodlands. Stads: A1, 2, 4; B4, 5; C1-3; D3; F6.

Juncus longistylis - Recorded around one slough and in a Salix stand. Stands: C2; D3.

Juncus tenuis - Freshwater marsh edge.

Liliaceae

Allium geyerii - Considered rare in Alberta by Packer and Bradley (1978). One specimen found on a grassy east slope.

Allium textile - Found commonly but in low numbers in dry grasslands. Stands: F4; H3, 4, 7; J1,1 K2, 3, 4.

Lilium philadelphicum var. andinum - Small stands were found in moist fescue grasslands and in open woodlands.

Smilacina stellata - Fairly comon in willow and aspen poplar groves. Stands: D1, 2, 4, 5, 6; E2-6.

Zygadenus gramineus - An uncommon species of grassland areas.

Iridaceae

Sisyrinchium montanum - Found in prarie and dry slough shores. Stands: B4; C2; G1; H3; K3, 4..

Orchidaceae

Corallorhiza trifida - One small stand found in a willow stand. Stand: D1.

Habenaria hyperborea - mesic willow area. Stand: D4; C2.

Salicaceae

Populus balsamifera - Found in moist woodlands. Stands: C2; D1, 3, 4; E2.

Populus tremuloides - The dominant tree in the reserve. Primarily in groves on north slopes and in depressions. Stands: B2, 6; C2; D2, 3, 5, 6; E1-6.

Salix bebbiana - Connom around sloughs and occasional on moist slopes. Stands: D1-4, 6; E6.

Salix discolor - Uncommon, moist depressions. Stands: E6.

Salix interior - Uncommon, moist depressions. Stands: A1.

Salix lutea - Found in 3 of the 6 *Salix* stands inspected. Stands: D5-6.

Salix petiolaris - Common, the dominant *Salix* spp. Found in moist depressions and on slopes. Stands: A1, 3; B1, 6, 7; C2; D1-6.

Salix pseudomonticola - willow stand. Stand: D4.

Betulaceae

Betula occidentalis - willow stand. Stand: D4.

Santalaceae

Comandra pallida - Fairly common in dry grasslands. Stands: F1, 3; H1, 4, 7; I1, 3; J1, 3; K1-5.

Polygonaceae

Eriogonum flavum - Dry grassland species, not common. Stand: K5.

Polygonum achoreum - roadside.

Polygonum amphibium var. stipulaceum forma histrosum. Stand: D4.

Polygonum convolvulus - Fairly common, moist woodlands and wet meadows. Stands: B2; D6; E6; G1.

Rumex maritimes - Found in sloughs and wet meadows. Stands: A1, 2, 3, 4, 5; B2, 3.

Rumer occidentalis - Occasional in moist areas. Stands: B2, 6; E6.

Chenopodiaceae

Axyris amaranthoides - wolfwillow - buckbrush stand. Stand: G2.

Chenopodium album - Widespread in reserve. Found in woodlands, grasslands and disturbed sites. Stands: B1, 2; E6; K4; C2, 3.

Chenopodium glaucum - Uncommon, moist saline sites. Stands:; B1.

Salicornia rubra - Fairly common, moist saline areas. Stands: C1-3.

Suaeda depressa - Farily common, saline slough edges. Stands: C2, 3.

Caryophyllaceae

Arenaria lateriflora - An uncommon woodland species. Stands: D1; E1, 3.

Cerastium arvense - A species widespread in the reserve, common. Stands: E4; F3, 4; H1-7; I1, 2, 3; K4; M1.

Stellaria longifolia - Common in moist areas. Stands: A1; B1, 6, 7; D1, 2, 3, 6; E1, 3, 5, 6; G1.

Stellaria longipes - Uncommon species of moist woodlands.

Ranunculaceae

Anenome canadensis - A moist woodland species, common in reserve. Stands: B4; D1-6; E1, 3, 4, 5, 6; F2, 3.

*Anenome cylindrica - Prairie species.

Anenome multifida - Found once in a S. occidentalis stand and once in the fescue grassland. Stand: H2.

Anenome patens - Common throughout grasslands. Stands: F1, 4; G2; H1-7; I1l-5; J1, 2, 3; K1-6; M2.

Ranunculus cardiophyllus - Found in moist grasslands.

Ranunculus circinatus var. subrigidus - An aquatic that is fairly common in the reserve. Stands: A3, 4, 5; B7.

Ranunculus cymbalaria - Occupies moist shorelines and depressions, fairly common. Stands: A1, 2,5; B4, 5; C1-2.

Ranunculus gmelinii - Found in sloughs. Stands: A1, 3, 4, 5.

#Ranunculus inamoenus - Rare, in moist grasslands.

Ranunculus pedatifidus - Fairly common prairie species, moist areas. Stands: E4.

Ranunculus sceleratus - Fairly common in sloughs on slough edges. Stands: A1, 3, 4, 5; B7; C2.

Thalictrum venulosum - Common in woodlands. Stands: D1, 2; E1, 4, 5.

Cruciferae

Arabis divaricarpa - Found on dry grassland slopes, uncommon.

Arabis glabra - Recorded once in an aspen grove. Stands: E4.

Arabis hirsuta var. pycnocarpa - Fairly common in grasslands. Stands: G1,3; H4; I2; E4.

Arabis holboellii var. retrofracta - Fairly common grassland species. Stand: G1.

Barbarea orthoceras - Uncommon, moist areas.

Brassica kaber var. pinnatifida - Rare. Several specimens found in the ditch of the recently constructed secondary highway.

Capsellla bursa-pastoris - Fairly common in the disturbed areas along the vehicle trail.

*Conringia orientalis - Rare, found in *Stipa* - *Artemisia* stands in Seciton 14.

Descurainia pinnata - Uncommon species recorded once in an *S. occidentalis* stand. Stand: F6.

Descurainia sophia - Common plant of disturbed areas. Also fund in wet areas. Stands: A2; B2.

Draba nemorosa - Uncommon, found in dry prairie and disturbed areas.

Erysimum cherianthoides - Uncommon, moist sites. Stands: B1; E1; F6.

Erysimum inconspicuum - Common in grasslands and open woodlands. Stands: E1; H2; I5; J1, 3; K1, 2, 3, 4, 5.

Lepidium densiflorum - Uncommon, disturbed sites and occasionally in thickets. Stands: G1, 2.

Lesquerella arenosa - Uncommon, dry slopes and disturbed areas alongside vehicle trails.

Rorippa islandica - Fairly common in disturbed areas and moist places. Stands: A3; B1, 2; G1, 2.

Sisymbrium altisimum - A plant of disturbed areas. Uncommon in the reserve. Stand: F5.

Sisymbrium loeselii - Disturbed areas.

Thlaspi arvense - Fairly common in disturbed areas along the vehicle trails. Stand: B2.

Saxifragaceae

Heuchera richardsonii - Widespread in reserve - grasslands and woodlands. Stands: E1, 2, 4, 5, 6; F4; G1, H3, 4, 5, 6; K4, 5, 6; M1.

Parnassia palustris - Uncommon, slough edges. Stands: B4; C2.

Ribes oxyacanthoides - Part of shrub canopy II in woodlands, and occasionally found in moist grassland. Stands: D1, 4; E2-6; F2; G1, 3.

Rosaceae

Agrimonia striata - Found twice in the reserve in the woodland/grassland ecotone. Stands: D4; G3.

Amelanchier alnifolia - Forms part of underbrush (shrub canopy II) in aspen poplar groves and willow stands. Stands: D1, 6; E3, 5.

Fragaria virginiana var. glauca - Found in both woodlands and dry prairie. Stands: B6; D1, 2, 4, 5; E2-6; G1, 3.

Geum allepicum var. strictum - Fairly common, moist areas. Stands: A1, B1, 6; D1, 2, 4, 5, 6; E1, 3, 5, 6; G1, 3.

Geum triflorum - Widespread in prairie. Stands: F4; G1; H1-7; I5; J1, 3; K1, 3, 4, 5; M1, 2.

Potentilla anserina - Common, moist grasslands and in depressions. Stands: A1, 4; B2-7; C1-3; D1, 2, 3, 4, 5.

Potentilla arguta - Fairly common in grasslands. Stands: F1, 3; H1, 2, 7; K4; M1.

Potentilla concinna - Fairly common in dry grasslands. Stands: H6; I1, 3; K2, 3.

Potentilla effusa - Scattered throughout dry areas of grasslands. Stands: I3, 5; J1, K4, 5; M1.

Potentilla gracilis - Found most commonly in fescue grassland. Stands: B4; D5; H1, 2, 3, 6; K3, 4.

*Potentilla hippiana - Uncommon in grassland.

Potentilla norvegica - A species of wet meadows. Stands: A2; B1, 2, 6.

Potentilla pensylvanica - Fairly common, dry grassland. Stands: H4, 7; I2, 4, 5; J1, 2; K1, 3, 5, 6; M1, 2.

Potentilla rivalis - Uncommon, wet meadows. Stands: A1, 3, 5; B6, 7.

#Rosa acicularis - Found on grassy hilltops.

Rosa arkansana - Fairly common in dry grasslands. Stands: J2, 3; K1,1 4.

Rosa woodsii - A dominant shrub in woodlands, fairly common in grasslands also. Stands: B4; D1-6; E1-6; F1-6; G1-3; H1, 2, 3, 5; K2, 3, 5, 6.

Rubus strigosus - Fairly common shrub of woodlands. Stands: D1, E2, 4, 5, 6.

Leguminosae

Astragalus agrestis - Fairly common, grasslands. Stands: B4, H4, 5; K3.

Astragalus bisulcatus - Fairly common, grasslands. Stands: H3, 4; I4; K3.

Astragalus canadensis - Found in small stands in moist grasslands and woodlands. Stands: D3; H1, 2, 3.

Astragalus crassicarpus - Found in grassy hillside.

*Astragalus drummondii - Dry grassland species, uncommon.

Astragalus flexuosus - Fairly common in dry grasslands. Stands: H7; I3; K1, 6.

Astragalus pectinatus - Fairly common, dry grassland.

Astragalus striatus - Found in _Stipa_ - _Festuca_ grassland.

Hedysarum alpinum - Uncommon species, found in fescue grassland. Stands: H3, 6.

Lathyrus ochroleucus - Fairly common, woodlands. Stands: D1; E1, 5; G2.

Oxytropis campestris - Fairly common on prairie. Stands: H1, 6; K3, 5.

Oxytropis deflexa var. foliolosa - Found in moist grasslands. Stand: D3.

Oxytropis sericea var. spicata - Found on grassy slopes and ridges, fairly common.

Petalostemon purpureum - Uncommon, in dry grasslands, especially on slopes. Stands: I5; K1, 5, 6.

*Psoralea esculenta - Found in _S. occidentalis_ stands.

Thermopsis rhombifolia - Common and widespread in reserve. Stands: D4; F2-5; G1, 3; H3; I1, 2; J3; K1, 3, 4, 5.

Vicia americana - Common in woodland groves. Stands: D1-6; E1, 2, 4, 5, 6; F1l 2, 4; G1, 2.

Vicia sparsifolia - A common grassland species. Stands: F5, 6; H4-7; I2, 4; J1, 2, 3; K2.

Geraniaceae

*Geranium bicknellii - Uncommon plant of disturbed soil and open woodlands.

*Geranium viscosissimum - Uncommon plant of fescue grassland and thickets.

Linaceae

Linum lewisii - Fairly common in dry grassland. Stand: K5.

Malvaceae

Sphaeralcea coccinea - Common species of disturbed sites and dry grassland. Stands: I3, 4; J2; K2, 5.

Violaceae

Viola adunca - Widespread and common in reserve. Stands: B4; D1, 4, 5; E1-5; F2; G1,1 3; I1, 2.

Viola nuttallii - Found in prairie grassland but uncommon. Stand: K3.

Elaeagnaceae

Elaeagnus commutata - A dominant species in the Elaeagnus - Symphoricarpos community type. Five stands were found in the reserve. This species was also found in a few thickets. Stands: D2, G1-3.

Onagraceae

Epilobium angustifolium - Common in moist grassland and open woodlands. Stands: B7; D1-6; E1, 4, 5, 6; F1, 3, 6; G2.

Epilobium glandulosum - Edge of slough.

Epilobium palustre - Uncommon, moist locations. Stands: A1; B7; D4.

Gaura coccinea - Fairly common in dry grasslands. Stands: H3; I1, 5; K2, 3, 6.

Oenothera nuttallii - Recorded in dry grasslands, uncommon. Stands: F2; K4.

Haloragidaceae

Myriophyllum exalbescens - Common in sloughs.

Umbelliferae

Musineaon divaricatum var. hookeri - Dry, sandy ground.

Sium suave - Fairly common in wet meadows and sloughs. Stands: A2, 3, 4; B5, 7.

Zizia aptera - Fairly common in moist grasslands. Stands: C1; D2, 4, 5; E1, 3, 4; H3.

Cornaceae

Cornus stolonifera - A shrub species of aspen poplar groves and willow stands. Stand: D2.

Pyrolaceae

Pyrola sarifolia - Uncommon, moist areas in woodlands. Stands: D2, 5; E3.

Pyrola secunda - Found once in an aspen poplar stand. Stand: E5.

Primulaceae

Androsace septentrionalis var. puberulenta - Fairly common in dry grasslands. Stands: H3; I3; K6.

Dodecatheon radicatum - Found most commonly in moist grasslands. Stands: B4; D4; G1; H1, 2, 6; I1.

Glaux maritima - A salt tolerant species found on the shores of saline sloughs. Stands: C1-3.

Lysimachia ciliata - Uncommon, moist woodlands. Stand: D6.

Primula incana - Uncommon, slough edges and moist woodlands. Stands: C2; D4.

Gentianaceae

Gentiana fremontii - unknown collection site.

Gentianella amarella ssp. acuta - Found in fescue grasslands, uncommon.

Polemoniaceae

Collomia linearis - Uncommon, moist areas. Stand: B6.

Phlox hoodii - Forms a low dense mat in dry grasslands fairly common. Stands: J3; K1, 5.

Boraginaceae

Hackelia americana - Fairly common in woodlands. Stands: A1; B2; D1, 4, 66; E2-6; F6; G1, 3.

Lappula echinata - Found fairly commonly in disturbed areas and also in shrublands. Stands: H1, 2.

Lithospermum incisum - Uncommon, dry grassland and shrubland. Stand: G3.

*Lithospermum ruderale - Uncommon, moist grassland.

Labiatae

Galeopsis tetrahit - Found in moist woodlands and disturbed areas. Stands: E1; F2, 3.

Mentha arvensis var. villosa - Common, in moist areas. Stands: A1, 2, 5; B1, 2, 3, 5, 7; D1-4, 6; E2, 3.

Monarda fistulosa var. menthaefolia - Uncommon, at edge of shrub thickets.

Stachys palustris var. pilosa - Found commonly in woodlands and wet areas. Stands: S1, 5; B1, 2, 3, 5, 6, 7; D3-6; E3, 6; F5; G1.

Solanaceae

Solanum triflorum - Rare, found in disturbed soil in dry grassland. Stand: K4.

Scrophulariaceae

Orthocarpus luteus - Uncommon, dry grasslands. Stands: K4.

Penstemon gracilis - A species of moist grasslands, uncommon. Stand: I1.

Penstemon procerus - Fairly common, *S. occidentalis* stands and moist grasslands. Stands: F3, 4, 5; H2; J3.

Orobanchaceae

Orobanche fasciculata - A parasite on Compositae species, especially Artemisica spp. Uncommon. Stands: J1, K4.

Lentibulariaceae

#Utricularia vulgaris var. americana - Found in sloughs.

Plantaginaceae

Plantago major - Fairly common in thickets and moist areas. Stands: A1, 2, 5; B4, 5, 7; D2-6; E1, 4, 5.

Rubiaceae

Galium boreale - Common and widespread throughout reserve. Stands: B4; D1-6; E1-6; F1-5; G1k-3; H1-7; M1, 2.

Caprifoliaceae

Symphoricarpos occidentalis - Widespread and common in reserve. Forms a community type of its own in fescue grasslands. Stands: D2, 4, 5; E1, 2, 4, 5, 6; F1-6; G1-3; H1, 2, 6, 7; K2, 3.

Campanulaceae

Campanula rotundifolia - Fairly common in grasslands and aspen poplar groves. Stands: E1-4; F2-6; G1, 3; H1-6; I1-4; J2a, 3; K4, 6; M1.

Compositae

Achillea millefolium - Common and widespread in reserve. Stands: A1; B4, 6, 7; D3, 4, 5; E1, 3, 4, 5, 6; F1-4, 6; G1-3; H1-7; I1; J2; K1, 3, 4; M1, 2.

Achillea sibirica - Rare, in willow stands. Stand: D1.

Agoseris glauca var. agrestis - Uncommon grassland species.

Antennaria neglecta - Found on south grassy slopes, uncommon.

Antennaria nitida - Common in dry grasslands. Stands: D4; I1, 3; J2; K3, 4; M1, 2.

#Antennaria parviflora - Uncommon, dry grasslands.

Arnica flugens - Found in a S. occidentalis stand, uncommon. Stand: F1.

Artemisia campestris - Fairly common in disturbed sites and grasslands. Stands: A1; H2, 3, 5; I1, 5; J1, 3; K1, 5, 6.

Artemisia frigida - A dominant in two grassland community types. Found throughout grasslands and in the drier shrub stands. Stands: F1, 2, 3, 5; G1, 3; H2-7; I1-5; J1-3; K1-6; M2.

Artemisia ludoviciana - Common in grasslands. Stands: E6; F1, 2, 4, 5; G1, 2; H1, 2, 4, 6; I1; J3; K2, 4; M1.

Aster brachyactis - Slough edge. Stand: A2.

*Aster ciliolatus - Found in thickets, uncommon.

*Aster junciformis - Moist places, rare

Aster laevis var. geyeri - Found in moist grasslands and S. occidentalis stands, uncommon.

Aster pansus - Fairly common in grasslands and moist meadows. Stands: B5; H5, 6; I3, 5.

*Balsamorhiza sagittata - Prairie grasslands. Rare.

Bidens cernua - mesic site.

Chrysopsis villosa var. hispida - Fairly common in dry grasslands, especially on south-facing slopes. Stands: G2; H4; I2, 3, 5; J2, 3; K1, 3-6.

Cirsium arvense - Common in disturbed grasslands and in wet meadows, where it is a co-subdominant. Stands: A1, 2; B1-7; C2; D1, 2, 3, 6; E3, 6; F1, 2, 3, 6; G1.

Cirsium flodmanii - Uncommon in fescue grasslands. Stand: H4.

Cirsium vulgare - Normally found in grasslands but also found in an open aspen stand. Stands: E6; I5.

Crepis runcinata - Uncommon, moist locations. Stand: B4.

Crepis tectorum - Fairly common, moist locations. Stands: A5, E4; C2.

Erigeron caespitosus - Found throughout grasslands, common. Stands: H2-5, 7; I1-5; J2, 3; K1, 3-6; M2.

*Erigeron canadensis - Uncommon plant of moist areas.

Erigeron glabellus - Uncommon, moist shrubland and grasslands. Stands: H1, 6; M1.

Erigeron philadelphicus - Fairly common in moist areas. Stands: A1, 2; B5, 6; C2; D2, 3.

Erigeron pumilis - uncommon, dry grassy areas. Stand: M1.

Gaillardia aristata - A prairie species, fairly common. Stands: F6; H1-6; I5; I1, 3; K1, 3, 4, 5.

Grindelia squarrosa - Uncommon in dry grasslands. Stand: M1.

Gutierrezia sarothrae - Dry grasslands species, uncommon. Stand: J1.

Haplopappus lancolatus - Uncommon, wet meadows and shores. Stand: B4.

Haplopappus spinulosa - Widespread in grasslands, fairly common. Stands: H6; I2, 3, 4; J2; K2, 3, 5.

Hieracium umbellatum - Young aspen stand. Stands: E6; H6.

*Helianthus laetrflorus var. subrhomboideus - Rare, moist grasslands.

Helianthus nuttallii - Buckbrush community. Stand: F6.

Lactuca pulchella - Found in moist grasslands and woodlands. Stands: E6; F5; G3.

Lygodesmia juncea - Fairly common in dry grasslands. Stands: F5; H3, 5; I1, 3, 5; J3; K2-6.

Matricaria matricariodes - Uncommon species of disturbed areas.

Petasites sagittatus - Small stands found in wet meadows and moist woodlands. Stands: A3; B1; D2.

Senecio canus - A grassland species, uncommon.

Senecio congestus var. palustris - Fairly common on slough shores. Stands: A1; C2.

Senecio hydrophiloides - moist areas.

Senecio lugens - Uncommon plant of wet areas. Stand: B6.

Solidago decumbens - Fairly common in prairie.

Solidago lepida - Farily common in low grasslands. Stands: F3, 5, 6.

Solidago missouriensis - Widespread in reserve, fairly common. Stands: A1; B5; F2, 4, 5, 6; H2-6; K3-6; M1, 2.

Solidago graminifolia - Low grasslands. Stand: A3.

Solidago pruinosa - Fairly common species in low grasslands. Stands: A1; E6; H3.

Solidago rigida - Fairly common in willow thickets and grasslands. Stands: H5; M2.

Sonchus asper - buckbrush community. Stand: F6.

Sonchus arvensis - Found in most moist habitats and some disturbed areas. Stands: A1; B4; C1; D1-4, 6.

Sonchus uliginosus - Occupies the same habitats as S. arvensis. Stands: B5; C2, 3.

Taraxacum officinale - Common and widespread throughout the reserve. Stands: A1-4; B2-6; C1, 2; D1, 2, 4, 5, 6; E1-6; F1; G1-3; H2, 4, 6, 7; J1; K3; M1.

Tragopogan dubius - A fairly common grassland species. Stands: B2; E1, 6; F1, 3, 5; H4, 7; I2, 5; J2, 3; K2, 3, 5, 6.

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* Reported by Wroe (1971)

# Reported by Bradley and Bradley (1971).

Appendix 9. Canopy cover of species and strata in each community type.
a. Carex atherodes - Scolochloa festucarea - Eleocharis - Typha latifolia Community Type.

		Stand Number					
Species	Strata	1	2	3	4	5	Mean
Achillea millefolium		0.1	0	0	0	0	0.02
Agrostis scabra		0	0	0	0	5	1.00
Alisma sp.		0	0	0	0	0.1	0.02
Alopecurus aequalis		10	10	40	0	0	12.0
Artemisia campestris		0.1	0		0	5	1.02
Beckmannia syzigachne		15	10	3	0	5	6.60
Calamagrostis inexpansa		1	0	1	0	1	0.80
Carex atherodes		30	45	35	20	55	37.00
Carex praegracilis				1			0.20
Carex sp.					5		1.00
Cirsium arvense		15	1				3.20
Compositae sp.			0.1				0.02
Crepistectorum						1	0.20
Descuraina sophia			1				0.02
Eleocharis palustris		10	35	3	20	30	19.60
Epilobium palustre		3					0.60
Erigeron philadelphicus		5	1				1.20
Geum allepicum		0.1					0.02
Glyceria grandis		15	5	15		5	8.00
Hackelia floribunda		0.1					0.02
Hordeum jubatum		10	20	1	0.1	1	6.42
Juncus balticus		2	1		5		1.60
Juncus longstylis		5					1.00
Lemna minor				0.1	5	0.1	1.04
Lemna trisulca					0.1	0.1	0.04
Mentha arvensis		10	1			1	2.40
Petasites sagittatus				1			0.20
Plantago major		1	5			1	1.40
Poa palustris		10	1	1		1	2.60
Polygonum sp.				3		1	0.80
Potentilla anserina		1			5		1.20

Appendix 9. Canopy cover of species and strata in each community type.
a. Carex atherodes - Scolochloa festucarea - Eleocharis - Typha latifolia Community Type.

Species	Strata	Stand Number 1	2	3	4	5	Mean
Potentilla norvegica			1				0.20
Potentilla rivalis		0.1		0.1		0.1	0.06
Ranunculus cymbalaria		1	1			1	0.60
Ranunculus gmelini		0.1		0.1			0.04
Ranunculus sceleratus		1		0.1		5	1.22
Rumex maritimus		10	35	3	1	10	11.80
Salix interior		0.5					.01
Salix petiolaris		0.5		1			0.30
Scolochloa festucacea			35	15	65	50	33.00
Scirpus acutus		0	5	0	0	3	1.60
Scirpus paludosus		3	5	0	0	0	1.60
Scirpus validus		5	0	0.1	5	0	2.02
Senico congestus		10	0	0	0		2.00
Sium suave		0	0.1	0.1	0.1		0.06
Solidago missouriensis		0.1	0	0	0		0.02
Solidago pruinosa		5	0	0	0		1.00
Sonchus arvensis		5	0	0			1.00
Sonchus sp.		0	1		10		2.20
Stachys palustris var. pilosa		5	0		0	5	2.00
Stellaria longifolia		1	0		0	0	0.20
Taraxacum officinate		5	1	1	0.1	0	1.42
Typha latifolia		5	35	5	1	15	12.20
HERB-DWARF SHRUB LAYER		95	95	95	90	95	94.0
SHRUB CANOPY II		1	0	1	0	0	0.4

b. Carex atherodes - Scolochloa festucacea - poa palustris - Cirsium arvense Community Type

	Stand Number							
Species	1	2	3	4	5	6	7	Mean
Achillea millefolium				2		3	1	0.86
Agropyron smithii				1				0.14
Agropyron subsecundum		3		0.5				0.50
Agropyron trachycaulum		5						0.71
Agrostis alba						1		0.14
Agrostis scabra	2			3			20	3.57
Alopecurus aequalis							1	0.14
Anemone canadensis				0.1				0.01
Aster pansus					0.1			0.01
Astragalus agrestis				0.1				0.01
Beckmannia syzigachne	1	5				1	15	3.14
Calamagrostis inexpansa				0.1	1	5	1	1.01
Carex atherodes	50		20	20	30	90	35	35.00
Carex bebbii		10	5	20				5.00
Carex sp.		50						7.14
Chendopodium album		5						0.71
Chenopodium glaucum	1							0.14
Chenopodium leptophyllum	1							0,14
Cirsium arvense	3	5	95		5	20	5	19.00
Collomia linearis					1		0.14	
Crepis runcinata				5				0.71
Descurainia sophia	1							0.14
Dodecatheon radicatum				3				0.43
Eleocharis palustris					5		5	1.43
Epilobium angustifolium							1	0.14
Epilobium palustre							1	0.14
Equisetum laerigatum				5				0.71

b. Carex atherodes - Scolochloa festucacea - poa palustris - Cirsium arvense Community Type

Species	Stand Number 1	2	3	4	5	6	7	Mean
Fragaria virginiana var. glauca						1		0.14
Galium boreale				0.1				0.01
Geum allepicum	1					1		0.29
Glyceria grandis							10	1.43
Glyceria striata						1		0.14
Hackelia floribunda		0.1						0.01
Haplopappus lanceolatus				0.1				0.01
Hordeum jubatum	1	30	1	3	10	1	2	6.86
Juncus balticus				5	1			0.86
Mentha arvensis	5	3	3		5		5	7.00
Parnassia palustris				1				0.14
Petasites sagitatus		0.1						0.01
Plantago major				.1	1		5	0.87
Polygonum convolvulus		0.1						0.14
Polygonum sp.			3				2	0.71
Poa interior							20	2.86
Poa palustris	50	30		30		15	20	20.71
Poa pratensis						1		0.14
Populus tremuloides (Shrub C. II)		0.1				1		0.16
Potentilla anserina		2	3	20	10	15	5	7.86
Potentilla gracilis				3				0.43
Potentilla norvegica	3	1				5	1	1.43
Potentilla rivalis						1		0.14
Potentilla sp.				1				0.14
Ranunculus circinatus							1	0.14
Ranunculus cymbalaria				.1	1			0.16
Ranunculus sceleratus							2	0.29
Rorippa islandica	1	0.1						0.16

b. Carex atherodes - Scolochloa festucacea - poa palustris - Cirsium arvense Community Type

	Stand Number							
Species	1	2	3	4	5	6	7	Mean
Rosa woodsii				2				0.29
Rumex occidentalis		0.1	0.1			1		0.17
Salix petiolaris (Shrub C. II)	1					1	1	0.43
Scirpus paludosus						1		0.14
Scolochloa festucacea	70	5			70	40	30	30.71
Senico lugens					3			0.43
Sisyrinchium montanum				1				0.14
Sium suave					0.1		1	0.16
Solidayo missouriensis					0.1			0.01
Sonchus arvensis				20				2.86
Sonchus sp.		1	20				5	3.71
Sonchus uliginosus					10			1.43
Sphenopholis intermedia				1				0.14
Stachys palustris var. pilosa	5	5	0.1		5	5	1	3.01
Stellaria longifolia	1					1	5	1.0
Taraxacum officinale		3	5	5	1	3		2.43
Thalspi arvense		0.1						0.01
Tragopogon dubius		0.1						0.01
Triglochin maritima				1				0.14
Viola adunca				.1				0.01
HERB-DWARF SHRUB LAYER	95	99	95	95	85	99	98	95
SHRUB CANOPY II	1	0	0	2	0	2	0	0.71

c. Scirpus paludosus - Puccinellia nuttalliana - Hordeum jubatum - Distichlis stricta Community Type

Species	Stand Number 1	2	3	Mean
Agropyron smithii	0	0	1	0.30
Agropyron sp.	1	0	0	0.30
Agropyron subsecundum	0	1	0	0.30
Beckmannia syzigachne	0	0.1	0	0.03
Carex aurea	0	1	0	0.30
Carex sp.	10	1	0	3.70
Chenopodium glaucum	0	0	1	0.30
Chenopodium rubrum	0	0.1	0	0.03
Chenopodium sp.	1	0	0	0.30
Cirsium arvense	0	1	0	0.30
Distichlis stricta	25	0.1	30	18.40
Eleocharais palustris	1	10	20	10.30
Erigeron philadelphicus	0	0.1	0	0.03
Glaux maritima	3	10	5	6.00
Habenaria viridius	0	1	0	0.30
Hordeum jubatum	10	25	30	21.70
Juncus balticus	3	10	5	6.00
Parnassia palustris	0	1	0	0.30
Poa palustris	0	5	0	1.70
Poa secunda	1	0	0	0.30
Potentilla anserina	1	10	5	5.30
Populus balsamifera	0	0.4	0	0.01
Populus tremuloides	0	0.1	0	0.03
Primula incana	0	0.1	0	0.03
Puccinellia nuttalliana	30	15	30	25.00
Ranunculus cymbalaria	1	15	1	5.70
Ranunculus sceleratus	0	1	0	0.30
Salicornia rubra	5	10	0.1	5.03
Salix petiolaris	0	0.5	0	0.02
Scirpus americana	0	10	10	6.70
Scirpus paludsous	50	20	45	38.30
Senico sp.	0	0.1	0	0.03

c. Scirpus paludosus - Puccinellia nuttalliana - Hordeum jubatum - Distichlis stricta Community Type

Species	Stand Number 1	2	3	Mean
Senico congestus var. palustris	0	5	0	1.70
Sisyrinchium montanum	0	0.1	0	0.03
Sonchus arvensis	5	0	0	1.70
Sonchus ulginosus	0	5	15	6.70
Suaeda depressa	0	0.1	10	3.33
Taraxacum officinale	1	5	0	2.70
Triglochin maritima	5	5	0	3.30
Zizia aptera	0.1	0	0	0.03
HERB-DWARF SHRUB LAYER	42	75	75	64
SHRUB CANOPY II	0	1	0	0.33

d. Salix petiolaris Community Type

Species	Strata	Stand Number 1	2	3	4	5	6	Mean
Achillea millefolium				1	1	1		0.50
Achillea sibirica		0.1						0.02
Agrimonia striata					1			0.17
Agrostis scabra							3	0.5
Amelanchier alnifolia (Shrub C. II)		15					0.1	2.50
Anemone canadensis		10	5	10	1	5	1	5.40
Antennaria nitida					1			0.17
Arenaria laterifolia		1						0.17
Astragalus canadensis				1				0.17
Beckmannia syzigachne				0.1				0.02
Bromus anomalus					1		5	1.00
Bromus ciliatus			0.1					0.02
Calamagrostis inexpansa				0.1				0.02
Carex bebbii			1					0.17
Carex sp.		5						0.83
Cirsium arvense		2	0.1	5			5	2.02
Corallorhiza trifida		1						0.17
Cornus stolonifera (Shrub C. II)		1						0.17
Corylus cornuta (Shrub C. I)					0.1			0.02
Dodecatheon radicatum					0.1			0.02
Elaeagnus commutata (Shrub C. II)		0	1					0.17
Epilobium angustifolium		10	1	5	10	5	15	7.67
Epilobium palustre					0.1			0.02
Equisetum arvense		5	0.1		1			1.02
Erigeron philadelphicus			0.1	1				0.18
Fragaria virginiana var. glauca		5	1		5	5		2.66
Galium boreale		1	0.1	5	3	5	1	2.50

d. Salix petiolaris Community Type

	Stand Number						
Species	1	2	3	4	5	6	Mean
Geum allepicum	1	5		5	1	0.1	2.02
Habenaria viridus var. bracteata				1			0.17
Hackelia floribunda	1			0.1		3	0.69
Juncus balticus			2				0.30
Juncus longstylis			5				0.83
Lathyrus ochroleucus	1						0.17
Lysimachia ciliata						0.1	0.02
Mentha arvensis	3	0.1	5	5		5	3.02
Oxytropis splendens			0.1				0.02
Petasites sagittatus		0.1					0.02
*Plantago major		0.1	0.1	5	0.1	5	1.72
Poa palustris	2		10	30	1	10	8.83
Poa pratensis		1					0.17
Polygonum coccineum				1			0.17
Polygonum convolvulus						0.1	0.02
Populus tremuloides (Tree C.)	0	0.1	1	0	.1	2	0.53
Populus tremuloides (Shrub C. II)	0	1	5	0	0	3	1.5
Populus balsamifera (Tree C.)	1						0.17
Popuus balsamifera (Shrub C. II)			0.1		0.1		0.03
Potentilla anserina	5	1	0.1	5	1		6.02
Potentilla gracilis					1		.17
Primula incana				0.1			0.02
Pyrola asarifolia		3			5		1.33
Ribes oxyacanthoides	1	0.1		3			0.68
Rosa woodsii (Shrub C. II)	15	5	1	5	5	3	5.70
Rubus strigosus	1						0.17
Salix bebbiana (Tree C.)	0	0	0	85	0	30	19.20

d. Salix petiolaris Community Type

Species	Stand Number 1	2	3	4	5	6	Mean
Salix bebbiana							
(Shrub C. I)	30	5	1	0	0	30	11.00
(Tree C.)	0	0	0	0	0	30	5.00
Salix lutea							
(Shrub C. II)	0	0	0	1	0	0	0.17
Salix petiolaris							
(Shrub C. I)	70	95	84	15	65	30	60.00
Smilacina stellata	3	0.1		1	0.1	0.1	0.72
Sonchus arvensis	1	16	15	20	0	10	10.30
Stachys palustris var. pilosa			1	5	1	1	1.33
Stellaria longipes	1					1	0.33
Stellaria longifolia		0.1	0.1				0.03
Symphoricarpos occidentalis							
(Shrub C. II)	0	5		5	20		5.71
Taraxacum officinale	1	1		10	1	1	2.33
Thalictrum sp.	0	0	0	1	0	0	0.17
Thalictrum venulosum	1	0.1			1		0.35
Thermopsis rhombifolia					0.1		0.02
Vicia americana	1	0.1	1		0.1	3	0.87
Viola adunca		0.1		1	1		0.35
Zizia aptera		0.1		1	1		0.35
Tree Canopy	1	0.1	1	85	0.1	60	24.5
Shrub Canopy I	85	95	85	15	65	30	62.5
Shrub Canopy II	25	11	6	15	25	6	14.7
Herb Dwarf Shrub Layer	30	25	20	50	10	35	33.0

e. Populus tremuloides Community Type

Species	Strata	Stand Number 1	2	3	4	5	6	Mean
Achillea millefolium	1	3	0	1	1	1	1	1.17
Agropyron subsecundum	1	1	0		5			1.0
Agropyron repens	1		0	0.1			1	0.18
Agrostis scabra		5						0.83
Amelanchier alnifolia (Shrub C. I)						1		.17
Amelanchier alnifolia (Shrub C. II)				10				1.7
Anemone canadensis		1		1	1	5	1	1.5
Arabis glabra					0.1			0.02
Arenaria lateriflora		1		5				1.0
Artemisia ludoviciana							5	0.83
Bromus anomulus					5		3	1.33
Bromus ciliatus						1		0.17
Bromus inermis							3	0.5
Bromus pumpellianus		5		5				1.67
Calamagrostis inexpansa			10				0.1	1.68
Campanula rotundifolia		1	1	0.1	1		0.1	0.55
Chenopodium album							0.1	0.02
Carex praticola					25	1		4.33
Carex sp.			10					1.67
Cerastium arvense					1			0.17
Cirsium arvense				20			0.1	3.35
Cirsium vulgare							0.1	0.02
Cirsium sp.		5						0.83
Compositae sp.							0.1	0.02
Epilobium angustiffolum		1			1	3	25	5
Erysimum cheiranthoides		1						0.17
Erysimum inconspicuum		1						0.17
Fragaria virginiana var. glauca			5	5	3	1	0.1	2.35
Galeopsis tetrahit		5						0.83

e. Populus tremuloides Community Type

Species	Stand Number 1	2	3	4	5	6	Mean
Galium boreale	5	5	1	15	5	10	6.83
Geum allepicum var. strictum	1		1		2	0.1	0.68
Hackelia floribunda		0.1	1	25	2	0.1	4.7
Heuchera richardsonii	1	0.1		0.1	2	0.1	0.55
Hordeum jubatum	1			1			0.33
Lactuca pulchella						3	0.5
Lathyrus ochroleucus	1				1		0.33
Mentha arvensis		1	1				0.33
Plantago major	1			1	2		0.67
Poa interior				1		5	1
Poa palustris				1			0.17
Poa pratensis						1	0.17
Poa sp.			5				0.83
Polygonum convolvulus						0.1	0.02
Populus balsamifera		10					1.67
Populus tremuloides (Tree C. I)	85	65	85	50	75	10	61.67
Populus tremuloides (Tree C. II)		15			0		2.50
Populus tremuloides (Shrub C. I)	0	0	0	0	10	0	1.67
Populus tremuloides (Shrub C. II)	5	5	10	5	0	75	16.67
Pyrola asarifolia			5				0.83
Pyrola secunda					0.1		0.02
Ranunculus pedatifidus				0.1			0.02
Ribes oxyacanthoides (Shrub C. II)		10	5	1	1	3	3.33
Rosa woodsii (Shrub C. II)	5	5	10	40	50	35	24.17
Rubus strigosus (Shrub C. II)		10		20	5	5	6.67

e. Populus tremuloides Community Type

Species	Stand Number 1	2	3	4	5	6	Mean
Rumex occidentalis						0.1	0.02
Salix bebbiana						2	0.33
Salix discolor						3	0.5
Smilacina stellata		1	0.1	1	0.1	1	0.53
Solidago pruinosa						5	0.83
Stachys palustris var. pilosa			0.1			3	0.52
Stellaria longifolia	1		0.1		3	3	1.18
Symphoricarpos occidentalis (Shrub C.II)	40	25		30	55	25	29.17
Taraxacum officinale	1	0.1	1	1	5	1	1.52
Thalictrum venulosum	5			0.1	1		1.02
Tragopogon dubius	1					0.1	0.18
Vicia americana	1	5		10	5	5	4.33
Viola adunca	1	1	1	3	1		1.17
Zizia aptera	1		0.1	0.1			0.20
Tree Canopy I	85	65	85	50	75	10	61.67
Tree Canopy II	0	15	0	0	0	0	2.50
Shrub Canopy I	0	0	0	0	11	0	1.83
Shrub Canopy II	50	50	30	75	90	85	63.33
Herb-Dwarf Shrub Layer	54	20	30	75	30	45	49.33

f. Symphoricarpos occidentalis Community Type

Species	Stand Number						
	1	2	3	4	5	6	Mean
Achillea millefolium	4	1	5	1		0.1	1.85
Agropyron subsecundum	5	2	1	5	5	1	3.17
Allium textile				0.1			0.02
Anemone canadensis	5	3					1.33
Anemone patens	1			1			0.33
Arnica sp.	1						0.17
Artemisia frigida	5	0.1	5		1		1.85
Artemisia ludoviciana	5	15		5	5		5.00
Bromus anomalis		2				5	1.17
Bromus pumpellianus	5					5	1.67
Campanula rotundifolia		1	0.1	0.1	1	0.1	0.38
Carex praticola				35	15		8.33
Carex sp.	5	5					1.67
Cerastium arvense			1	0.1			0.18
Cirsium arvense	5	1	2			10	3.00
Comandra pallida	1		1				0.33
Descurainia pinnata						1	0.17
Epilobium angustifolium	1		1			5	1.17
Erysimum cheiranthoides						1	0.17
Festuca scabrella		0.1	5			25	5.02
Gaillardia aristata			0.1			0.1	0.03
Galeopsis tetrahit		3	0.1				0.52
Galium boreale	2	5	5	5	10		4.50
Geum triflorum				1			0.17
Hackelia floribunda						1	0.17
Heuchera richardsonii				0.1			0.02
Hordeum jubatum			1				0.17
Juncus balticus						0.1	0.02
Lactuca pulchella					0.1		0.02
Lygodesmia juncea					0.1		0.02
Oenothea nuttalli		0.1					0.02
Penstemon procerus			5	1	0.1		1.02
Poa interior			1				0.17

f. Symphoricarpos occidentalis Community Type

Species	Stand Number 1	2	3	4	5	6	Mean
Poa palustris						1	0.17
Poa sp.		0.1					0.02
Potentilla arguta	1		5				1.00
Ribes oxyacanthoides (Shrub C.II)			1				0.17
Rosa woodsii (Shrub C. II)	5	30	20	1	2	5	10.50
Sisymbrium altissimum					1		0.17
Solidago missouriensis		0.1		1	1	3	0.85
Solidago pruinosa			1		5	5	1.83
Sonchus sp.						3	0.50
Stachys palustris var. pilosa					1		0.17
Stipa spartea var. curtiseta				0.1		0.1	0.03
Stipa viridula	4	1	1	1	5	0.1	2.02
Symphoricarpos occidentalis (Shrub C. II)	80	70	70	80	95	75	78.33
Taraxacum officinale	1						0.17
Thermopsis rhombifolia		5	1	1	1		1.33
Tragopogon dubius	1		0.1		1		0.35
Vicia americana	1	1		0.1			0.35
Vicia sparsifolia					1	3	0.67
Viola adunca		0.1					0.02
Shrub Canopy II	80	80	85	90	97	75	85
Herb-Dwarf Shrub Layer	40	20	15	70	20	45	35

g. Elaeagnus commutata - Symphoricarpos occidentalis Community Type

	Stand Number			
Species	1	2	3	Mean
Achillea millefolium		1	1	0.67
Agropyron repens	3	0.1		1.03
Agropyron subsecundum	2			0.67
Agrostis scabra		0.1		0.03
Agrimonia striata			5	1.67
Anemone patens.		0.1		0.03
Arabis hirsuta			0.1	0.03
Artemisia frigida			0.1	0.03
Artemisia ludoviciana		1		0.33
Bromus inermis	0.1	1		0.37
Campanula rotundifolia			1	0.33
Carex bebbii		0.1		0.03
Carex praticola	0.1	1		0.37
Cerastium arvense			1	0.33
Chrysopsis villosa		0.1		0.03
Cirsium arvense	1			0.33
Cirsium sp.			10	3.33
Elaeagnus commutata (Shrub C. I)			50	16.67
Elaeagnus commutata (Shrub C. II)	40	60	0	33.33
Epilobium angustifolium		10		3.33
Fragaria virginiana var. glauca	1		1	0.67
Galium boreale	1	5	10	5.33
Geum allepicum	5		5	3.33
Hackelia floribunda	5		15	6.67
Hordeum jubatum	1		1	0.67
Lactuca pulchella			5	1.67
Lathyrus ochroleucus		1		0.33
Lepidium densiflorum		0.1		0.03
Polygonum convolvulus	0.1			0.03
Poa palustris	5	5		3.33
Ribes oxyacanthoides (Shrub C. II)	0.1		1	0.37
Rorippa islandica	0.1	15		5.03

g. Elaeagnus commutata - Symphoricarpos occidentalis Community Type

Species	Stand Number 1	2	3	Mean
Rosa woodsii (Shrub C. II)	60	10	10	26.67
Salix sp. (Shrub C. I)			5	1.67
Sonchus sp.			10	3.33
Stachys palustris var. pilosa	0.1			0.03
Stellaria longifolia	0.1			0.03
Stipa viridula	0.1			0.03
Symphoricarpos occidentalis	60	50	35	48.33
Taraxacum officinale	0.1	1	1	0.70
Thermopsis rhombifolia			0.1	0.03
Vicia americana	.1	.1		0.07
Viola adunca			1	0.33
Shrub Canopy I	0	0	50	16.67
Shrub Canopy II	95	99	45	79.67
Herb-Dwarf Shrub	10	5	40	18.33

h. Festuca scabrella Community Type

Species[a]	Stand Number 1	2	3	4	5	6	7	Mean
Achillea millefolium	1	1	2	1	5	1	1	1.71
Agropyron dasystachyum	1							0.14
Agropyron subsecunda	10	5	10			3	10	4.00
Agrostis scabra	5	1		0.1			1	1.01
Allium textile			1	1			1	0.43
Androsace septrionalis			1					0.14
Anemone multifida		0.1						0.014
Anemone patens	1	5	10	5	5	5	5	5.14
Arabis hirsuta				0.1				0.014
Arnica sp.			1					0.14
Artemisia campestris		1	1		1			0.43
Artemisia frigida		1	5	5	5	1	15	4.57
Artemisia ludoviciana	15	10		1		5		4.43
Aster pansus					0.1	0.1		0.03
Astragalus agrestis				1	5			0.86
Astragalus bisulcatus	0.1		1	5				0.87
Astragalus canadensis	1	0.1	1					0.3
Astragalus flexuosus							5	0.71
Campanula rotundifolia	1	1	3	1	3	2		1.57
Carex filifolia			5					0.71
Carex sp.							20	2.86
Cerastium arvense	0.1	1	1		1	0.1	0.1	0.47
Chrysopsis villosa				0.1				0.014
Cirsium floodmanii				0.1				0.014
Comandra pallida	1			1			1	0.43
Cruciferae sp.	1							0.14
Danthonia intermedia	1		1	5		0.1	5	1.73
Dodecatheon radicatum	1	1				1		0.43
Erigeron caespitosus		1	1	5	1		1	1.29
Erigeron glabellus	1					0.1		0.16
Erysimum inconspicuum		0.1						0.014
Festuca scabrella	75	60	85	85	90	90	70	79.29
Gaillardia aristata	1	1	1	0.1	0.1	0.1		0.47

h. Festuca scabrella Community Type

	Stand Number							
Species[a]	1	2	3	4	5	6	7	Mean
Galium boreale	25	20	5	1	10	1	5	9.57
Gaura coccinea			1					0.14
Geum triflorum	1	5	3	1	1	1	1	1.86
Haplopappus spinulosus						1		0.14
Hedysarum alpinum			1			0.1		0.16
Heuchera richardsonii			1	0.1	0.1	0.1		0.19
Koeleria cristata	1	1						0.14
Lappula echinata	1	0.1						0.16
Lygodesmia juncea			1		1			0.29
Oxytropis campestris var. gracilis	1					0.1		0.16
Penstemon procerus		5						0.71
Poa interior	5		1				5	1.57
Potentilla arguta	1	2					1	0.57
Potentilla concinna						1		0.14
Potentilla gracilis	1	1	1			1		0.57
Potentilla pensylvanica				0.1			0.1	0.03
Rosa woodsii	1	0.1	10		0.1	1		1.74
Sisyrinchium montanum			1					0.14
Solidago missouriensis		1	1	1	1	1		0.71
Solidago pruinosa			1					0.14
Solidago rigida					0.1			0.01
Stipa spartea var. curtiseta	1		1	15				2.43
Symphoricarpos occidentalis	20	5				10	2	5.26
Taraxacum officinale		1		1		1	1	0.57
Thermopsis rhombifolia			2					0.29
Tragopogon dubius				0.1			0.1	0.03
Vicia sparsifolia				0.1	0.1	0.1	0.1	0.06
Zizia aptera			1					0.14
Herb-Dwarf Shrub Layer	99	96	95	95	90	95	80	93

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a. All species in Herb-Dwarf Shrub Layer

i. Stipa spartea var. curtiseta - Festuca scabrella Community Type.

Species[a]	Stand Number 1	2	3	4	5	Mean
Achillea millefolium	1		1			0.40
Agropyron riparium			0.1			0.02
Agropyron subsecundum	1					0.20
Androsace septentrionalis			1			0.20
Anemone patens	5	5	10	5	1	5.20
Antennaria nitida	2		2			0.80
Arabis hirsuta		0.1				0.02
Artemisia campestris	1				1	0.40
Artemisia frigida	15	10	25	15	10	15.0
Artemisia ludoviciana	1					0.20
Aster pansus			5		1	1.20
Astragalus sp.	1	0.1			0.1	0.44
Astragalus bisulcatus				1		0.20
Astragalus flexuosus			1			0.20
Bouteloua gracilis	1		1	3	0.1	1.02
Campanula rotundifolia	3	0.1	0.1	0.1		0.66
Cerastium arvense	1	1	1			0.60
Chrysopsis villosa		0.1	0.1		1	0.24
Cirsium vulgare					1	0.20
Comandra pallida	3		1			0.80
Danthonia intermedia	5		5	1	1	2.40
Dodecatheon radicatum	1					0.20
Elymus hirtiflorus				1		0.20
Erigeron caespitosus	1	2	3	8	1	3.00
Erysimum inconspicuum					0.5	0.10
Festuca scabrella	35	40	20	10	40	29.00
Gaillardia aristata					0.1	0.02
Gaura coccinea	0.1				2	0.42
Geum triflorum					5	1.00
Haplopappus spinulosus		0.1	1	1		0.42
Koeleria cristata	5	1	5	5	0.1	3.22
Lygodesmia juncea	1		0.1		1	0.42
Penstemon gracilis	1					0.20

i. Stipa spartea var. curtiseta - Festuca scabrella Community Type.

	Stand Number					
Species[a]	1	2	3	4	5	Mean
Petalostemon purpureum					1	0.20
Poa secunda			5	10		3.00
Potentilla concinna	1		5			1.20
Potentilla effusa			3		0.1	0.62
Potentilla pensylvanica		0.1		5	0.1	1.04
Rosa woodsii	5		0.1		0.1	1.04
Solidago sp.					1	0.20
Sphaeralcea coccinera			0.1	8		1.62
Stipa spartea var. curtiseta	30	50	10	25	30	29.00
Thermopsis rhombifolia	15	0.1				3.02
Tragopogon dubius		1			1	0.40
Vicia sparsifolia		1		5		1.20
Viola adunca	0.1	0.1				0.04
Herb-Dwarf Shrub Layer	90	80	85	75	90	84

[a] All species within herb-dwarf shrub layer

j. Stipa spartea var. curtiseta - Artemisia frigida Community Types

	Stand Number			
Species[a]	1	2	3	Mean
Achillea millefolium		1		0.30
Allium textile	0.1			0.03
Anemone patens	1	5	5	3.67
Antennaria nitida		5		1.67
Arabis sp.		0.1		0.03
Artemisia campestris	0.1		1	0.37
Artemisia frigida	45	20	15	26.67
Artemisia ludoviciana			10	3.33
Astragalus sp.	0.1	0.1	0.1	0.10
Bouteloua gracilis	5	7	5	5.67
Campanula rotundifolia		0.1	1	0.37
Carex filifolia	5			1.67
Cerastium arvense		0.1	1	0.37
Chrysopsis villosa		1	5	2.00
Comandra pallida	5		1	2.00
Danthonia intermedia	0.1	10		3.37
Erigeron caespitosus		1	10	3.67
Erysimum inconspicuum	0.1		0.1	0.07
Festuca scabrella	20	5		8.33
Gaillarda aristata	0.1		0.1	0.07
Geum triflorum	0.1		1	0.37
Guthierrezia sarothrae	5			1.67
Haplopappus spinulosa		1		0.33
Koeleria cristata	1	7	5	4.33
Lygodesmia juncea		0.1	0.1	0.07
Orobanche fasciculata	0.1			0.03
Oxytropis sp.	0.1	0.1		0.07
Penstemon procerus			0.1	0.03
Phlox hoodii			0.1	0.03
Poa secunda		10		3.33
Potentilla effusa	0.1			0.03
Potentilla pensylvanica	0.1	0.1		0.07
Rosa arkansana		1	10	3.67

j. Stipa spartea var. curtiseta - Artemisia frigida

Species[a]	Stand Number 1	2	3	Mean
Selaginella densa			55	18.33
Solidago sp.		.1		0.03
Sphaeralea coccinea		1		0.33
Stipa spartea var. curtiseta	45	50	40	45.00
Taraxacum officinale	0.1			0.03
Thermopsis rhombifolia			20	6.67
Tragopogon dubus		0.1	0.1	0.07
Vicia sparsifolia	.1	1	1	0.70
Herb-Dwarf Shrub Layer	95	70	95	86.67%

a. All species within herb-dwarf shrub layer

k. Bouteloua gracilis - Artemisia frigida Community Type

Species	Stand Number 1	2	3	4	5	6	Mean
Achillea millefolium	1		0.1	5			1.02
Agropyron sp.	0.1			1			0.18
Agrostis scabra				0.1			0.02
Allium textile		1	1	0.1			0.35
Androsace septentrionalis						0.1	0.02
Anemone patens	1	1	5	5	2	1	2.50
Antennaria nitida			5	5			1.67
Antennaria sp.	1				1		0.33
Artemisia campestris	0.1				1	1	0.35
Artemisia frigida	30	10	5	20	20	15	16.67
Artemisia ludoviciana		0.1		10			1.68
Astragalus agrestis			0.1				0.02
Astragalus bisulcatus			0.1				0.02
Astragalus flexosus	1					1	0.33
Astragalus sp.					0.1	0.1	0.03
Bouteloua gracilis	15	50	65	40	25	25	35.00
Campanula-rotundifolia				0.1		0.1	0.03
Carex sp.				10			1.67
Cerastium arvense				1			0.17
Chenopodium album				1			0.17
Chenopodium leptophyllum		5			1		1.00
Chrysopsis villosa	5		1	0.1	1	1	1.35
Comandra pallida	10	0.1	1	1	1		2.18
Danthonia intermedia	1		1	0.1	1	5	1.35
Erigeron caespitosus	0.1		1	1	0.1	0.1	0.38
Eriogonum flavum					0.1		0.02
Erysimum inconspicuum	0.1	0.1	0.1	1	0.1		0.23
Festuca scabrella				0.1		5	0.85
Gaillarda aristata	0.1		1	0.1	1		0.37
Gaura coccinea		1	0.1			0.1	0.20
Geum triflorum	1		1	1	1		0.67
Haplopappus spinulosus		0.5	3		1		0.75
Heuchera richardsonii				3	0.1	0.1	0.53
Koeleria cristata	40	1	5	5	10	15	12.67
Linum lewsii					1		0.17

k. Bouteloua gracilis - Artemisia frigida Community Type

Species	Stand Number						Mean
	1	2	3	4	5	6	
Lygodesmia juncea		1	1	0.1	1	0.1	0.53
Muhlenbergia cuspidata	0.1					5	0.85
Oenothera nuttallii				0.1			0.02
Orobanche fasciculata				0.1			0.02
Orthrocarpus luteus				0.1			0.02
Oxytropis campestris			1		0.1		0.18
Petalostemon purpureum	0.1				0.1	0.1	0.05
Phlox hoodii	5				0.1		1.83
Poa secunda	5					1	1.00
Potentilla arguta				1			0.17
Potentilla cocinna		1	1				0.33
Potentilla effusa				1	2		0.50
Potentilla gracilis			0.1	3			0.52
Potentilla pensylvanica	0.1		0.1		1	0.1	0.22
Ranunculus sp.		0.1					0.02
Rosa arkansana	0.1			15			2.52
Rosa woodsii		3	10		0.1	15	4.68
Selaginella dense	1			10			1.83
Sisyrinchium montanum			0.1	0.1			0.03
Solanum triflorum				0.5			0.08
Solidago missouriensis			0.1	5	0.1	0.1	0.88
Sphaeralcea coccinea		5			0.1		0.85
Stipa spartea var. curtiseta	10	5	15	5	5	2	7.00
Symphoricarpos occidentalis		1	1				0.33
Taraxacum officinale			5				0.83
Thermopsis rhombifolia	1		1	10	0.1		2.02
Tragopogon dubius		1	1		1	0.1	0.52
Vicia sparsifolia		0.1					0.02
Viola nuttalli			1				0.17
Herb-Dwarf Shrub Layer	70	85	95	80	60	80	78.33

a. All species within herb-dwarf shrub layer

1. Koeleria cristata - Agropyron smithii Community Type (from Wroe 1971)

Species	Canopy Cover (%)
Achillea millefolium	5
Agropyron smithii	46
Agropyron subsecundum	0.1
Anemone patens var. wolfgangiana	0.1
Antennaria nitida	4
Artemisia frigida	7
Artemisia ludoviciana	0.3
Bouteloua gracilis	4
Carex eleocharis	35
Cerastium arvense	0.3
Chenopodium leptophyllum	0.1
Deschampsia caespitosa	2
Distichlis stricta	8
Erigeron caespitosus	0.5
Grindelia squarrosa	13
Gutierrezia sarothrae	0.2
Hordeum jubatum	3
Koeleria cristata	59
Muhlenbergia cuspidata	0.2
Poa secunda	15
Potentilla arguta	0.1
Potentilla gracilis	0.2
Potentilla pensylvanica	0.3
Selaginella densa	59
Sphaeralcea coccinea	0.3
Stipa spartea var. curtiseta	0.8

a. All species within herb-dwarf shrub layer

m. Agrostis scabra - Achillea millefolium - Artennaria nitida Community Type

Species[a]	Stand Number 1	2	Mean
Achillea millefolium	15	15	15
Agrostis scabra	30	15	225
Anemone patens		1	0.5
Antennaria nitida	15	15	15
Artemisia frigida		5	2.5
Artemisia ludoviciana	10		5
Bouteloua gracilis		5	2.5
Campanula rotundifolia	1		0.5
Carex sp.	10		5
Cerastium arvense	2		1
Erigeron caespitosus	1	1	1
Erigeron sp.	2		1
Galium boreale	15	.1	7.55
Geum triflorum	10	5	7.5
Grindelia squarrosa	1		0.5
Heuchera richardsonii	1		0.5
Koeleria cristata		5	2.5
Oxytropis sp.	5		2.5
Poa interior	30		15
Poa palustris	5		2.5
Poa secunda		3	1.5
Potentilla arguta	1		0.5
Potentilla gracilis	1		0.5
Potentilla pensylvanica	1	1	1
Selaginella densa		5	2.5
Solidago missouriensis	1	1	1
Solidago rigida		0.1	0.05
Stipa spartea var. curtiseta		1	0.5
Taraxacum officinale	1		
Herb-Dwarf Shrub Layer	90	75	82.50

a. All species within herb-dwarf shrub layer

Appendix 10

Annotated list of birds observed in the candidate reserve

Podicipedidae

Horned Grebe (Podiceps auritus): Five individuals seen on sloughs in the nothern part of the reserve. One nesting grebe observed.

Ardeidae

Great Blue Heron (Ardea herodias): One observed in slough #17 and one in a slough in the NW quarter of Section 14.

*Black-crowned Night Heron (Nycticorax nycticorax): An immature was observed flying over the area.

Anatidae

Canada Goose (Branta canadensis): Four seen on slough #35 during waterfowl survey and four again in late July. Two seen in Section 21. According to a ranchhand a pair of geese nested in a tree in Section 28 in 1982.

Mallard (Anas platyrhynchos): Common on sloughs. Accounted for 15.8% of the ducks and geese recorded during the waterfowl survey.

Gadwall (Anas strepera): Common on sloughs. Made up 15.5% of the waterfowl.

Pintail (Anas acuta): Uncommon (3% of surveyed waterfowl) on sloughs.

Green-winged Teal (Anas carolinensis): Fairly common (13.0%) on sloughs.

Blue-winged Teal (Anas discors): Most common duck in the reserve. 21.5% of surveyed waterfowl.

American Wigeon (Mareca americana): Fairly common (11.0% of surveyed waterfowl) on sloughs.

Shoveler (Spatula clypeata): Fairly common on sloughs. 10.0% of surveyed waterfowl.

Redhead (Aythya americana): Rare on sloughs. Seen on sloughs 32 and 35. Accounted for 1.8% of surveyed waterfowl.

*Ring-necked Duck (Aythya collaris): Two individuals and a small flock seen on sloughs in the reserve area.

Canvasback (Aythya valisineria): Three individuals seen on slough #35. Accounted for less than 1% of surveyed waterfowl.

Lesser Scaup (Aythya affinis): Uncommon on sloughs. Seen on sloughs #32, 35 and 38. Made up 6.5% of waterfowl surveyed.

*Bufflehead (Bucephala albeola): One pair seen on a deep slough in the reserve area.

*Ruddy Duck (Oxyura jamaicensis): Two pair seen on a slough in Section 19 and expected in the reserve.

Accipitridae

Sharp-shinned Hawk (Accipiter striatus): Two identified in Section 15. Uncommon.

Cooper's Hawk (Accipiter cooperii): One sighted by slough #17 in Section 16.

Red-tailed Hawk (Buteo jamaicensis): Fairly common in reserve. Three active nests were found and more are expected.

*Swainson's Hawk (Buteo swainsoni): One pair seen in reserve area and an individual was seen over the glacial spillway.

Marsh Hawk (Circus cyaneus): Uncommon, one seen in Section 17 flying over a slough.

Falconidae

Pigeon Hawk or Merlin (Falco columbarius): One seen flying overhead in Section 22.

Tetraonidae

Ruffed Grouse (Bonasa umbellus): One individual seen in an aspen poplar grove in Section 15. They were oftem heard drumming in the distance.

Sharp-tailed Grouse (Pedioecetes phasianellus): Fairly common in grasslands. Several seen in Sections 16, 21 and 28.

Phasianidae

*Gray Partridge (Perdix perdix): One seen in reserve area along a road.

Rallidae

Sora (Porzana carolina): One heard calling fraom a slough (A3) in Section 14.

*American Coot (Fulica americana): One observed in a slough in Section 24 and ranchers have seen coots in the area in the past. Suitable habitat is present in the reserve and the reason for their absence is unknown.

Charadriidae

Killdeer (Charadrius vociferus): Fairly common in reserve around sloughs. One nest found on the shores of Slough #12.

Scolopacidae

Common Snipe or Wilson's Snipe (Capella gallinago): Heard flying overhead (winnowing) and seen in emergent vegetation zone of sloughs.

Upland Plover (Bartramia longicauda): Often heard whistling, seen occasionally in grasslands.

Spotted Sandpiper (Actitis macularia): A few found around sloughs.

Willet (Catoptrophorus semipalmatus): Seen usually in Section 17 near sloughs or flying overhead.

Lesser Yellowlegs (Totanus flavipes): Seen by sloughs, uncommon.

Semipalmated Sandpiper (Ereunetes pusillus): Flocks of about 30 birds seen on slough #1 and 17.

Marbled Godwit (Limosa fedoa): Occasionally seen on slough shores.

Recurvirostridae

American Avocet (Recurvirostra americana): Several seen on saline sloughs #1, 12 and 17.

Phalaropodidae

Wilson's Phalarope (Steganopus tricolor): Fairly common on sloughs.

Laridae

Ring-billed Gull (Larus delawarensis): One seen on slough #17.

Franklin's Gull (Larus pipixcan): Seen flying overhead and on sloughs. They only foraged in the reserve.

Black Tern (Childonias niger): Uncommon in reserve. Probably only foraged in the reserve.

Columbidae

Mourining Dove (Zenaidura macroura): Often heard calling from aspen poplar groves and occasionally seen while roosting or foraging.

Strigidae

Short-eard Owl (Asio flammeus): One flew through camp in NW 1/4 of Section 21.

Picidae

Hairy Woodpecker (Dendrocopos villosus): One individual seen in an aspen grove in Section 20.

Tyrannidae

Eastern Kingbird (Tyrannus tyrannus): Fairly common along edges of willow and aspen poplar groves, especially in the burned area.

*Traill's Flycatcher or Alder Flycatcher (Empidonax traillii): Scarce in willows around sloughs.

Least Flycatcher (Empidonax minimus): Fairly common in aspen poplar and willow groves around sloughs.

Alaudidae

Horned Lark (Eremophila alpestris): Uncommon in disturbed areas of grassland.

Hirudinidae

Tree Swallow (Iridoprocne bicolor): Commonly seen in reserve, often in the company of barn swallows.

Barn Swallow (Hirundo rustica): Common near the old buildings in section 23; uncommon elsewhere in the reserve.

Corvidae

Black-billed Magpie (Pica pica): Common in the reserve.

Common Crow (Corvus brachyrhynchos): Common in the reserve.

Paridae

Black-capped Chickadee (Parus atricapillus): Fairly common in woodlands.

Troglodytidae

House Wren (Troglodytes aedon): Seen fairly often in dense aspen poplar and willow groves.

Mimidae

Catbird (Mimus polyglottos): One seen in willows around slough #17.

Turdidae

American Robin (Turdus migratorius): Fairly common in reserve.

Mountain Bluebird (Sialia currucoides): Two seen in grasslands of section 20.

Motacillidae

Sprague's Pipit (Anthus spraguoii): Fairly common in grasslands. Usually heard singing while circling in the air.

Bombycillidae

Cedar Waxwing (Bombycilla cedrorum): A few individuals seen in aspen poplar and willow groves of burned area.

Sturnidae

*Common Starling (Sturnus vulgaris): Seen in region but none were observed in the reserve in 1982.

Vireanidae

Red-eyed Vireo (Vireo olivaceus): Inhabits aspen poplar and willow groves. It was not seen often.

Warbling Vireo (Vireo gilrus): One seen in willows of Section 23, uncommon.

Parulidae

Black and White Warbler (Mniotilta varia): One seen in aspen poplar grove of Section 15.

Yellow Warbler (Dendroica petechia): Fairly common in dense willow groves around sloughs.

*Common Yellowthroat (Geothlypis trichas): Uncommon in marshes.

Icteridae

Western Meadowlark (Sturnella neglecta): One seen in grasslands on moraine plateau in Section 28.

Yellow-headed Blackbird (Xanthocephalus xanthocephalus): Uncommon, a few seen near sloughs in the reserve.

Red-winged Blackbird (Agelaius phoeniceus): Fairly common in marshes.

Baltimore Oriole or Northern Oriole (Icterus galbula): Occasional in aspen poplar grove.

Brewer's Blackbird (Euphagus cyanocephalus): Uncommon in shrubland near sloughs.

Brown-headed Cowbird (Molothrus ater): Uncommon in reserve.

Fringillidae

American Goldfinch (Spinus tristis): Fairly common in shrublands and weedy areas of grasslands.

Savannah Sparrow (Passerculus sandwichensis): Common in grassland near shrubs.

*Baird's Sparrow (Ammodramus bairdii): Rare, local populations in areas with tall grass, such as ungrazed grassland of NW 1/4 of Section 14.

Le Conte's Sparrow (*Passerherbulus caudacutus*): One seen in the large marsh in the NW 1/4 of Section 22 and NE 1/4 of Section 23.

Vesper Sparrow (*Pooecetes gramineus*): Common in grasslands intersperred with shrubs.

Chipping Sparrow (*Spizella passerina*): Uncommon in willow and aspen poplar groves.

Clay-colored Sparrow (*Spizella pallida*): Common in willow thickets.

White-crowned Sparrow (*Zonotrichia leucophrys*): Uncommon in aspen poplar and willow groves.

White-throated Sparrow (*Zonotrichia albicollis*): Uncommon in aspen parkland and willow thickets.

Song Sparrow (*Melospiza Melodia*): One seen in willow thicket.

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* Reported by Bradley and Bradley (1977).

Appendix 11

Total indicated ducks and geese on surveyed sloughs.

Pond No.	Mal	Gad	Wig	GWT	BWT	Sho	PT	Red	LSc	Can	CG	Total
	Species*											
1	2		4	4								10
2	2	2		6	4	2						16
3		2	2		2		2					8
4												0
5		2			6	2	0					10
6	4	2			2	6						14
7		6	2	4	10	2	2					26
8	2											2
9		2	2				2					6
10												0
11		6	2	2	2							12
12	5	6	2	2	8	6						29
13			2			2						4
14	2	2										4
15	2		4									6
16	2	4		2	4							12
17	2	6	4	2	2							16
18			2									2
19	4											4
20				4		2						6
21					2							2
22						2						2
23												0
24		2		4	2		2					10
25												0
26	4	2			6	2						14
27						2						2
28												0
29												0
30		2										2
31	16	2				2	2					22
32	8	4	2	6	14	2	2	3	6			47
33					2							2
34			4	2	2							8
35	2	4			2	2		4	16	3	4	37
36		2			2							4
37		2	2	6	4							14
38	2	2				2			2			8
39			2									2
40												0
41	2											2
42			2	2	4							8
43			2		4							6
44	2		2									4
45				4								4
46			2	2	2	4			2			12
Total	63	62	44	52	86	40	12	7	26	3	4	399
Percent of Total	15.8	15.5	11.0	13.0	21.6	10.0	3.0	1.8	6.5	.8	1.0	100

* Mal = Mallard, Gad = Gadwall, Wig = American Wigeon, GWT = Green-Winged Teal, BWT = Blue-Winged Teal, Sho = Shoveler, PT = Pintail, Red = Redhead, LSc - Lesser Scaup, Can = Canvasback, CG = Canada Goose.

Appendix 12

Annotated list of mammals observed and expected to occur in the candidate reserve. Compiled from observations, Banfield (1977) and Salt (1975).

Soricidae

No species observed but the masked shrew (Sorex cinereus) and pygmy shrew (Microsorex hoyi) are expected.

Vespertilionidae

Little Brown Bat (Myotis luncifugns): Expected in the reserve.

Long-eared Bat (Myotis evotis): Specimens from the Rumsey vicinity and expected in the reserve.

Long-legged Bat (Myotis volans): Expected in the reserve.

Small-footed Bat (Myotis leibii): Specimens from the Rumsey vicinity and Red Deer River near the reserve.

Silver-haired Bat (Lasionycteris noctivagans): Expected in the reserve.

Big Brown Bat (Eptesicus fuscus): Specimens from the Rumsey region.

Hoary Bat (Lasiurus cinereus): Expected in the reserve as a migrant.

Leporidae

Snowshoe Hare (Lepus americanus): May occur in the reserve but none observed.

White-tailed Jack Rabbit (Lepus townsendii): One individual seen in the reserve and one observed about 50m from the reserve's west fence. Probably rare in the reserve.

Sciuridae

Least Chipmunk (Eutamias minimus): Expected in aspen poplar groves.

Woodchuk (Marmota monax): None observed. Records of it occuring in the area but unusual.

Richardson's Ground Squirrel (Spermophilus richardsonii): Fairly common in reserve but the population is localized into three separate colonies. The colonies are located in disturbed areas such as water wells.

Thirteen-lined Ground Squirrel (Spermophilus tridecemlineatus): Fairly common in reserve. Observed singly in areas with good cover.

Franklin's Ground Squirrel (Spermophilus franklinii): Expected to inhabit aspen poplar groves in the reserve.

Geomyidae

Northern Pocket Gopher (Thomomys talpoides): None observed but mounds seen in depressions.

Castorida

American Beaver (Caster canadensis): One individual and one abandoned lodge seen in two ponds in the northern part of the reserve.

Muridae

Deer Mouse (Peromyscus maniculatus): Expected in the reserve and specimens have been taken from the vicinity.

Gapper's Red-backed Vole (Clethrionomys gapperi): May occur in reserve occasionally as the reserve is on the south edge of the vole's range.

Muskrat (Ondatra zibethicus): Suitable habitat is found in the reserve but none observed. Salt found signs of muskrats in sloughs in the region and ranchers have seen many muskrats in the reserve. Unlikely that it is ever abundant here.

Prairie Vole (Microtus ochrogaster): Considered rare; populations are characterically local and scattered. Salt identified it from two skull fragments in coyote and owl scats.

Meadow Vole (Microtus pennsylvanicas): Many voles, believed to be of this species, were seen in moist meadows in kettle bottoms. Salt considered them "not numerous" at the time of his study. He found evidence of them living in the region from examination of raptor pellets.

Dipodidae

Western Jumping Mouse (Zapus princeps): One specimen taken from the region. Salt saw a jumping mouse that he belived to be of this species.

Meadow Jumping Mouse (Zapus hudsonius): May occasionally occur in the reserve.

Erethizontidae

American Porcupine (Erethizon dorsatum): Four individuals seen in the reserve. Judging by the number of willows stripped of their bark porcupines are fairly common. All four porcupines were seen while they were walking in the grass near aspen poplar or willow groves.

Canidae

Coyote (Canis latrans): Twenty-two sightings of coyotes were made. They were usually seen in pairs or singly. An active den was found by a rancher in 1982. Many old burrows were found. Salt found they preyed upon small rodents, hares and a varity of birds.

Red Fox (Vulpes vulpes): None obseved but they probably occur on occasion in the reserve.

Mustelidae

Ermine or Short-tailed Weasel (Mustela erminea): Specimens taken from the Rumsey and Drumheller regions. Expected in reserve.

Long-tailed Weasel (Mustela frenata): Expected in the reserve.

Least Weasel (Mustela nivalis): One individual seen in the region by Salt. Expected in the reserve.

American Badger (Taxidea taxus): Badgers have been seen rarely in the area by ranchers. Old abandoned dens were seen in the reserve. Salt found active dens in the region to the south.

Striped Skunk (Mephitis mephitis): Suprisingly none were seen in the reserve, and, according to the ranchers, they are rare in the area.

Cervidae

Mule Deer (Odocoileus hemionus): Fairly common in reserve. Thirteen sightings of this species were made.

White-tailed Deer (Odocoileus virginianus): Nineteen sightings made. Appear to be common in the reserve.

Moose (Alces alces): Occasionally one travels through the area. Three or four have been seen over the past three years.

Antilocapridae

Pronghorn (Antilocapra americana): The reserve is on the northern edge of their range. They are usually seen in the reserve in spring until late June.

Appendix 13 SPECIAL FEATURES

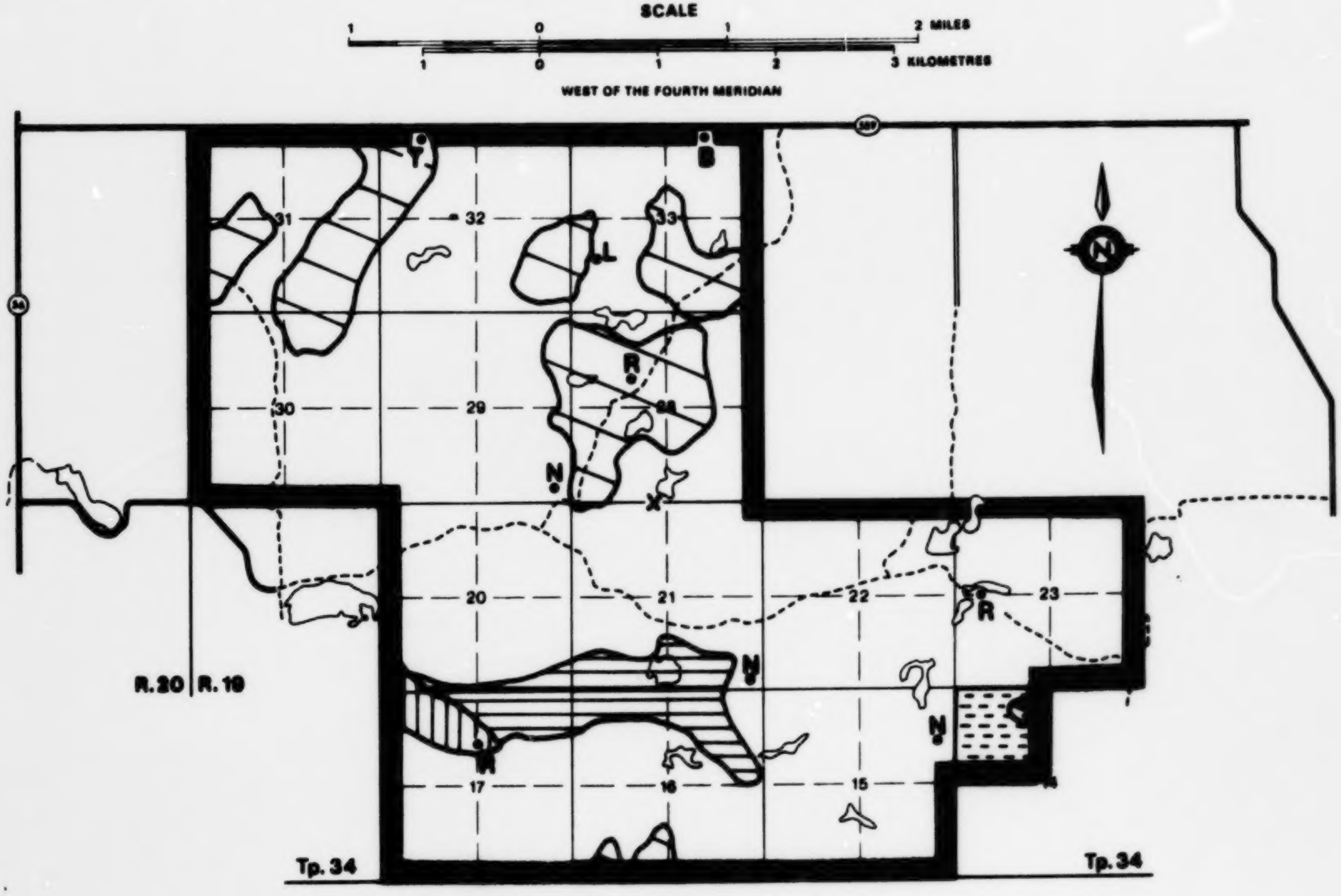
LEGEND

▨	Moraine Plateau with Local Rim Ridges of Till
▥	Glacial Spillway of Coarse Alluvium
▤	Esker Complex
T	White-tailed Jack-rabbit Sighting
B	Beaver Sighting
L	Abandoned Beaver Lodge
R	Richardson's Ground Squirrel Colony
N	Red-tailed Hawk Nests
X	Allium geyerii Location
░	Ungrazed quarter section

RUMSEY ECOLOGICAL RESERVE

SPECIAL FEATURES

■ Ecological Reserve Boundary


SCALE
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Tp. 34
Tp. 34

POOR

QUALITY

ORIGINAL